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Cincinnati Industrial Exposition.

PROPOSED PLANS OF ITS MANAGER—HIGHLY INTERESTING INDUCEMENTS OFFERED TO ELECTRIC LIGHT COMPETITORS—PREMIUMS FOR OTHER SUCCESSFUL ELECTRICAL COMPETITORS.

Ten successive times the Cincinnati Industrial Exposition has opened its doors to the public and closed them again after the show was over upon the satisfied and dissatisfied, upon the "just and unjust." Except in one or two instances success has attended the management of all the past exhibitions. In none of these cases was it the fault of the exhibitors or the exhibition itself, but rather from outside causes. All differences have now been settled, forever we hope, as the results of last year's success amply proves. But it is not our purpose to dig up the past, only as it will serve the purposes of the future, and we think enough good can be found in the past record of this institution to justify us in saying that the coming exposition which opens on September 5 and closes October 6 will be conducted in an able and efficient manner; that equal justice will be guaranteed to all competitors for the prizes offered, and that the beneficial result will more than repay any outlay that may be made by those in the electrical fields who may desire to enter the exposition.

CINCINNATI INDUSTRIAL EXPOSITION BUILDING.

The Board of Commissioners is composed of the following members of the Chamber of Commerce:

Thomas G. Smith, Ben. E. Hopkins, John E. Bell, Lawrence Mendenhall and S. F. Dana. Of the Board of Trade: Oliver Kinzey, Joseph A. Scarlett, W.W. Peabody, S. F.Covington, A. L. Fogg. And of the Ohio Mechanics' Institute, Hugh McCollum, Wm. H. Stewart, W.W. Collard, J. F. Walton and W. L. Dudley.

From these commissioners the following named officers have been elected and constitute the management of the exposition:

W. W. Peabody, President; Hugh McCollum, First Vice-President; Oliver Kinzey, Second Vice-President; John E. Bell, Third Vice-President; Wm. H. Stewart, Secretary; Benj. E. Hopkins, Treasurer, and John B. Heich, has been appointed Assistant Secretary.

To give the personal of the standing committees would occupy too much space, and we shall only give those whom our patrons will doubtless come in contact with sooner or later if they exhibit. The committee on "Rules, Jurors and Awards" consists of Messrs. Smith, Covington and Bell; on "Space," Messrs. Hopkins, Smith and Peabody; on "Building," Messrs. Collard, Walton, McCollum; on "Machinery and Appliances," Messrs. Fogg, Kinzey, Stewart, Stowe, and Withenbury. The most important committee to our readers is the one under whose management will come the electrical inventions and appliances of every description. Some fault could be found with its title and with the management too in not selecting an appropriate name which would more fully define its character and work.

The importance of electrical invention, the wide interest excited by its recent wonderful discoveries, would justify the management in selecting a committee having charge of this special interest and nothing else. But they have decided to group it under the head of "Scientific and Educational appliances," and Messrs. Dudley, (Chairman), Collard, Clarke, Springer and Feemster will preside over its destinies, so far as the management of the exposition is concerned. There are seven other committees having charge of other departments, which, if a fair representation is made in each, will create great interest and accomplish wonderful results.

We add here a few extracts from the prospectus in hand for general information to those interested before giving the list of premiums, which, notwithstanding our crowded columns, we publish in full.

"It is the intention of the committee on scientific and educational appliances to make the exhibit of electrical apparatus, instruments of precision, * * * * one of the largest and most attractive ever held in this country.

"In the regular premium list of this department, which is hereafter given, it has been the endeavor to include all important manufactures, and in case an article is not included it may be entered for a special premium. Exhibits of special merit will be duly recognized according to their worth."

Of course it will be the hope of every exhibitor that the committee will carry out the last sentence to its fullest extent, and from the high standing of the gentlemen who have been placed upon the committee, there is not a shadow of doubt that it will be. The annexed premium list is complete, and covers the whole subject of the scientific and mechanical application of electricity, except the very important one of *man* himself:

DEPARTMENT F, CLASS NO. 72.

Industrial Applications of Electricity, Telegraphic and Telephonic Apparatus, Electric Motors, Electric Lighting and Signaling Apparatus, Dynamo-Electric Machines, Electro-Plating Apparatus, etc.

	Premium.
Best System and Apparatus for Electric Lighting	Gold Medal.
Best Dynamo-Electric Machine	Silver "
Best Display of Electro-Plating Apparatus	Silver "
Best System for Automatic Telegraphy, in operation	Silver "
Best Pole Changer, for Reversing Line Currents	Silver "
Best System for Fire-Alarm Telegraph, in operation	Silver "
Best System for Telephone, in operation	Silver "
Best Acoustic Telephone	Silver "
Best Magneto Telephone Call Bell	Bronze "
Best Electro-Telephone Call Bell	Bronze "
Best Telephone Exchange Switch Board	Silver "
Best Telephone Transmitter	Silver "
Best System for Telegraphic Railway Signal	Gold "
Best Fire-Alarm Signal Box	Bronze "
Best Display of Telegraph Instruments and supplies	Silver "
Best Instruments for Quotations	Bronze "
Best Electric Hotel Annunciator	Silver Medal
Best Box Relay, Key Attached	Silver "
Best Switch for from four to twenty wires	Silver "
Best Telegraph Set, Key, Sounder and Relay	Bronze "
Best Magnetic Watchman's Clock	Bronze "
Best Printing Instrument for Private Line	Bronze "
Best Dial Instrument for Private Line	Bronze "
Best Amateur Telegraphic Instrument	Bronze "
Best Insulator for Telegraph Lines	Bronze "
Best Electric Gas-Lighting Apparatus	Silver "
Best Burglar Alarm	Bronze "
Best Electric Clock	Silver "
Best Electric Engine for Motive Power, not less than One Horse-Power, in operation	Gold "
Best Incandescent Electric Light	Gold "
Best Electric Turnstile Register	Silver "
Best Dynamo Electric Plating Machine, in operation	Gold "
Best Electric Railway	Gold "
Best Storage Battery, in operation	$100 00

For the application of electricity to the needs of man the following prize medals are offered:

Best Display of Instruments for Medical Electricity	Silver Medal.
Best Magnetic Appliance for Medical Purposes	Silver "
Best Cotury Galvanic Battery	Silver "
Best Galvanic Belts	Silver "

Beside the medals mentioned above the management of the exposition have distinguished themselves for their liberality in offering purses for the most efficient electric light systems.

The offer is told in the accompanying extract from the Committee's "Special Circular of the Department of Electric Lighting," as follows:

"Owing to the great and increasing importance of electricity, it has been decided to conduct special tests this year in electric lighting, and no expense has been spared in securing the services of a jury composed of the best experts in the country whose decision will be recognized as conclusive throughout the world. The following awards will be made:

Best system of incandescent electric lighting	$500 00

	Premium.
Second best system of incandescent electric lighting.....	300 00
(Not less than 200 incandescent lights must be in operation at such times, as they may be needed to light the space allotted for their exhibition.)	
Best system of arc electric lighting.....	500 00
Second best system of arc electric lighting.....	300 00
(Not less than 15 arc lamps must be in operation at such times, as they may be needed to light the space allotted for their exhibition.)	
Best storage battery (in operation).....	100 00
Best system of electric lighting (arc and incandescent combined).....	Gold Medal
Best incandescent electric light (single lamp).....	Gold Medal
Best dynamo-electric machine.	Silver Medal

An engine of the most improved pattern will be used exclusively to drive the dynamos, and it will be in operation one week before the opening of the exposition.

Companies desiring to bring their own engines may do so; but all the tests of the efficiency of apparatus will be made under similar conditions.

In deciding on the best systems of arc or incandescent lighting the jury will take into consideration the following factors:

Dynamos, lamps, conductors, fixtures, safety devices, regulating apparatus, manner of erection, including cost of operation, number of lamps per horse-power, economy, efficiency, &c.

Appliances for space should be made as soon as possible on the enclosed blank. The horse-power desired should also be stated, so that the proper arrangements can be made.

Many exhibitors will desire to have their displays lighted by electricity, for which they may be charged; but this will not be considered as a part of the regular exhibit (as competing for premiums) of the electric light company furnishing such lights.

Further information can be had by addressing the chairman of the committee.

(Signed)

WILLIAM L. DUDLEY, Chairman.
W. A. COLLORD,
F. W. CLARKE,
ALFRED SPRINGER,
J. H. FEEMSTER,
Committee on Scientific and Educational Appliances.

It is to be regretted that the electric railway exhibited at Chicago could not be secured as a novelty, but it is perhaps better as it is, and the management will be able to get a much finer demonstration of what can be done in electric locomotion next year than they can this.

Military Telegraphs During the Civil War.*

The London *Electrical Review*, in a very able article of following book, says that at first glance it may seem rather a late date, after an interval of eighteen years of peace, following the most embittered of wars, for W. R. Plum to have made the history of the American military telegraphs the subject of a special work, entitled "The Military Telegraphs during the Civil War in the United States," published by Jansen, McClury & Co., Chicago. The two volumes, of 767 pages, contain much that has hitherto been unpublished, and not only furnishes the historian with abundant material, but are of special value to the student of military telegraphy. Telegraphic operations were carried out in this war on a more extensive scale than has ever been done in other cases, even in the most modern wars. The field telegraph officer and the strategist may learn from Plum's work that the military telegraph can be employed not only between the headquarters of advancing armies, but also for the conveyance of information and orders to and from the front during reconnoitring operations and whilst in operation.

The opinion, supported as yet by comparatively few officers in European armies, that telegraphic transmission of orders, etc., can be used with advantage in tactical operations, should find but few opponents in face of the facts here revealed, and if experiments made during manœuvres have here and there given results which seem to contradict this opinion, the question should not be considered as settled, as it remains to be considered whether the *personnel* had been properly chosen and organized, and whether it had the necessary experience. Telegraphy at the front requires the most experienced men as operators, and fully competent officers who have no other duties to perform, for with non-experienced telegraphists success is not to be expected. The Federals fully proved this during the war.

The principal object of the author, however, is to procure recognition and justice, which, unpardonably and strangely enough, have not yet been accorded by the Government of the Republic to the Military Telegraph Corps of the United States, which took so important a part in the success of the four years' war. In this endeavor the author brings forward a mass of data, the historical value of which may be easily recognized from the fact that it contains telegrams from the President, the ministers and the commanding officers, which are not even to be found in the Government archives.

The author took part in the campaign as a Federal military telegraphist, and is therefore in a position to speak from personal experience. His present position as a barrister of high standing in Chicago exonerates him from all personal interest in his criticism of the American field telegraph service, and of those individuals who in its organization have won historical fame and the gratitude of all their compatriots. Amongst these, Anson Stager is particularly conspicuous as chief of the military telegraph, for to him belongs the fame of having created a telegraph corps, which fulfilled in a highly satisfactory manner the most trying demands which have ever been made on such a corps by any army.

At the outbreak of the war there existed in the United States army a small body constituting a so-called "signal corps," which used only optical signals, but the Federals on their part at once formed a military telegraph corps, which was recruited from the ranks of the civil telegraphists. The material for the first requirements was taken from the telegraph companies, and the existing lines were used for military purposes. The necessity for telegraph connection between the various army corps, the war ministry and the country, declared itself at the outburst of the war, and the military telegraph corps was thus created in a moment of need; it was accepted by the Minister of War, without, however, being confirmed by Congress. In this anomalous position lay the germ of the grievances of the corps, which the author by the publication of his work is endeavoring to remove.

The Military Telegraph Corps accompanied General McClellan's division, for the first time, on his march from Clarksburg to Buchanon, in the beginning of July, 1861, and the general staff declared itself at once in favor of telegraphic communication. At Rich Mountain, on the day of the battle, a field telegraph station was opened, which contributed in no small degree to McClellan's victory, and to the defeat of Generals Garnett and Pegram, by expeditiously conveying orders and enabling troops to be forwarded at the right moment. When McClellan extended his operations over the States of Missouri, Illinois, Indiana, Ohio, and West Virginia, the military telegraph alone rendered it possible to command with facility troops scattered over such an extensive territory.

The corps had no real military organization, and consisted of civilians. In August, 1861, General Fremont made an attempt to organize a military corps, to be led by General Smith, with a view to extending communication to the battlefield. The telegraph battalion was formed of experienced telegraphists; it consisted of three companies, and numbered altogether 86 men: 74 privates, 8 corporals, 2 lieutenants, 1 captain, and 1 major. This battalion was in active service up to November, and was then disbanded by order of the Minister of War, as General Fremont had not applied for consent to the formation of the corps. General Sickles also formed a telegraph company, constituted of men who had volunteered for three years' military service, which was known as the "Chester Telegraph Corps."

With the exception of these comparatively insignificant corps, the military telegraphs were entirely in the hands of civil volunteers. The zealous, conscientious, and skillful manner in which they carried out their difficult task speaks highly for the patriotic spirit of the corps, and the enormous activity which it developed during the war is the best proof of its usefulness and devotion. From the commencement of the war on the 25th April, 1861, until the 15th of November following, 1,831 kilometers of field lines and 106 military telegraph stations were erected, and the director-general, Anson Stager, was able to report to the Minister of War that the field telegraph was in a condition to follow the army on the march at the rate of 13 to 19 kilometers per day, and it formed the sole means of communication between the commanders of the different divisions and the ministry. Until October, 1861, the military operations in the extensive territory between Fort Munroe and New Mexico were conducted without unanimity of action and without a central command. This want of centralization existed not only in the army, but also in the field telegraph corps itself, but when General McClellan received the chief command of the army all this was altered. Anson Stager was made director-general of telegraphs with the rank of captain, in November, 1861, and was promoted to the rank of colonel in February, 1862. Thirteen inspectors of the telegraph corps received the ranks of captain and major, and in the later years of the war some few more inspectors became officers, otherwise the *personnel* retained its civil character and organization, though working in common with the soldiers and sharing in all their hardships and dangers.

The organization of the Confederate Telegraph Corps is also treated of in Plum's book.

The telegraph was recognized by the South as an important factor in the development of military operations; it did not, however, attain such proportions as in the Northern army. There was no organized military field telegraph corps, with the exception of a few local companies, as, for instance, at the siege of Charleston, under General Beauregard. With such few exceptions, the field telegraph of the Confederates was recruited from civil volunteers the same as in the North.

Eckert was appointed Telegraph Major of the Northern army and second in command to Colonel Stager. With Eckert, himself an experienced telegraph director, rested the special duty of maintaining a constant telegraphic connection between the different divisional headquarters.

Plum says: "It was worth regiments of soldiers to know that an attack on any point of McClellan's lines, many miles long, would be reported in time to be promptly met. It was worth 'a mint of money' to the people of the North to receive daily detailed reports of operations about Yorktown, but it was somewhat dangerous business for the telegrapher at the front."

When Captain F. R. Buchholtz, of the Prussian army, published in 1877 his valuable work "War Telegraphy," he particularly pointed out the need of extending the field telegraphs beyond the divisional quarters—the limit now assigned to it in Germany—so that it might be used in outpost service during reconnoitring and in battles. The experience of the American military telegraphs seems to have been unknown to European officers, for Buchholtz said in his work that only one case was on record in which telegraphy was used in actual battle, and that was at Fredericksburg. Plum's book, however, describes many cases* where telegraph stations were established on the battle field and during reconnoitring, and these facts even now, after a lapse of twenty years, still possess great importance. But we also learn that military telegraphy requires men of the highest practical training, and that no success can be expected from officers and men who have not made this branch their profession, but who merely possess a general acquaintance with the subject. Results can be obtained by thorough training that mediocrity could never rival, and this is true of telegraphy to an extent which to non-professionals may seem marvelous.†

The telegraph lines were often exposed to destruction by the enemy, and particularly by "franc tireurs." Linemen had almost daily to ride along the line to repair any immediate damage. Many of these men lost their lives, but as soon as one fell another took his place, and the Government in whose service they lost their lives has taken no notice of their fate, because they were not recognized Government officials. None of the wives or children of these men have ever received the slightest compensation — no memorial reminds us of these heroes, no salute has ever been fired over their graves.

Although the military telegraph proved of considerable efficiency at the commencement of the war, many officers, nevertheless, had no confidence in its well-earned reputation, and many a bloody and obstinate battle might have been avoided or shortened if the necessary telegraphic connection had been on the spot. In proof or this, Plum quotes especially the obstinate fighting at Fort Donelson under General Grant.

The Americans often tapped the enemies' lines, not only for the purpose of intercepting telegrams, but to send false orders and produce confusion. The Confederate Captain Morgan and Telegraphist Ellsworth, as early as 1862 gave their special attention to tapping the Federal lines, and the author gives most interesting accounts of such episodes. The Federals soon sent spies also to intercept the telegrams of the South.

It is remarkable that the Americans, in spite of these experiences, did not abstain from advancing their stations into the enemy's lines. The attempts to tamper with the wires were, however, quickly discovered and rendered harmless by using cipher telegrams. The knowledge of cipher telegraphy soon attained

* Translated by Lieutenant Bagnold, R. E., from the German of R. von Fischer Treuenfeld, in the *Elektrotechnischen Zeitschrift*.

* These cases are too numerous to relate. It will suffice to mention the most remarkable. On June 27th, 1862, Operator Jesse Bunnell erected a field station 300 feet in the rear of General Porter's army. During the engagement at Gaines' Mills this station was in uninterrupted operation and in communication with the reserves of McClellan's headquarters. Bunnell was for hours exposed to the enemy's fire, with no other shelter than a tree. The tumult and confusion of the fight and the constant distraction caused by the arrival of numerous telegrams greatly increased the difficulty of receiving by ear, and Bunnell's extraordinary ability alone enabled him to carry out the service. It was also necessary to make two or three copies of the telegrams and forward them by separate orderlies, as many of them were killed. General Porter was fighting with 35,000 men against overpowering forces, so that the telegraph was constantly required for the calling up of reserves. Without the aid of the telegraph, General McClellan could not possibly have gained the victory, which was only obtained at the cost of 9,000 men of his army and almost as many on the other side.

Plum closes his description of the invaluable services rendered by Bunnell during the battle of Gaines' Mills in these words: "What confidence to repose in a beardless operator, unhonored to this day!"

† The following case may also serve as an example: Telegraph-Superintendent Fuller had received orders to erect a line from Lebanon to Columbia for communication with General Boyle's division. When Fuller reached Columbia with the telegraph wires, the office apparatus was missing. General Boyle, who had important dispatches to send, was so enraged about the lost apparatus that he threatened to shoot Fuller. The latter, however, quietly took the General's messages and telegraphed them (in default of a key) by touching the ends of the cut wire, and received all answers correctly by applying the wires on and under his tongue, General Boyle, who was highly astounded at Fuller's proceedings, and perhaps a little ashamed, said, "You are too useful to be shot just yet."

Telegrams were often received by means of the tongue, when the apparatus had been lost or destroyed in battles. This was done by the author in the neighborhood of Clarkesville.

great perfection, and Plum describes very minutely the systems used, which might prove of considerable practical value to European telegraphists. Important telegrams, especially to the front, were always telegraphed in cipher. The cipher was often changed, and the key was intrusted to only a few telegraphists, and was not even known to the staff officers. A cipher telegraphist was attached to each of the headquarters, and the ability of these men in transcribing became so great that there was practically no delay in the transmission of the messages.

Although cryptography makes the interception of telegrams useless so far as gaining information is concerned, a source of security exists in the fact of the telegraphists reading by sound. Proficiency in reading by sound may indeed be regarded as an indispensable accomplishment at the front. Although the sounder has the disadvantage, in comparison with the recorder, of not registering telegrams, yet it has the great advantage of cultivating the operator's ear so as to enable him to receive messages in spite of defective insulation and feeble currents.

A telegrapher accustomed to the sounder can receive telegrams from defective lines when it would be impossible for one only used to the recorder to receive with that instrument under similar condition. This is important in outpost telegraphy, as the ear attains a certain power of recognizing a strange operator by the pace and quality of his signaling, and this is a further reaon why the *personnel* of outpost telegraphs should consist of the most skillful men only.

The astonishing perfection with which American telegraphists read by sound is explained by the circumstance that the sounder had been adopted in America since 1846, to the nearly entire exclusion of any other form of telegraph apparatus.*

Telegraphists frequently accompanied troops when reconnoitring, the reconnaissances being made on locomotives, so that the sphere of action of the telegraph was extended even beyond the outposts. This was not an exception, but a systematic practice, and General Haupt reports to the committee appointed under General Pope to inquire into the compaign in Virginia.

"I cannot speak in too strong terms of commendation of the zeal and courage of the railway employes and of the telegraph operators, who, with a full understanding that the service was very hazardous, volunteered for the occasion." The operators "proceeded with instructions to conceal themselves in the bushes, send out scouts, make connection with their wire, and report all that they saw or heard. Nearly all the information given to the department (War) at Washington for the remaining days of the fight was received through this channel."

Such telegraphs were often erected and taken down under fire, and were often abandoned with loss of men and material.* The building parties were exposed to the same dangers as the office operators. The former were also composed, with few exceptions, of civilians who received their orders from the divisional inspectors. Plum's work contains detailed descriptions of the difficulties under which the telegraph followed the marching armies. The author does not omit to mention the zeal and patriotism of these officials, especially of William Fuller, subsequently made a captain, who played an important part during the war.

The number of telegraphists who were captured in the exercise of their duties will be regarded as a proof of the extensive part which the telegraph played in the tactical operations during the war. It also indicates that telegraphists were not only the last men in a retreat, but were also frequently among the foremost in a reconnoitring expedition. Much valuable experience is to be gained from these facts when considering the organization of field telegraphy for European armies, where outpost telegraphy has never yet been even approximately brought to the state of perfection which it had attained in America twenty years ago.

Colonel Anson Stager reported to General Meigs on June 30th, 1863: "Follow the army where you will, there you will find the telegraph exercising its vigilance and protection over the surrounding camps. At the foremost picket-posts, in the rifle pits, and in the advanced parallels, at any hour of the day or of the night, you can listen to the mysterious, yet intellectual, click of the telegraph instruments, amidst the strife of battle and the whistling of bullets its swift silent messengers pass unseen and unharmed."

Plum urges the advisability of the telegraphic conveyance of orders on the battle-field, relying for its utility and safety upon his own experience and upon a number of historical facts. We must, however, point out to the author one mistake requiring correction. He says: "Captain Buchholtz, another German author, doubts the use of the telegraph on any battle-field, but the American instances are very numerous." Captain Buchholtz, however, has won more fame in Europe than any other man by his attempts to extend telegraphy to the out posts. He is the constructor of the best outpost apparatus, and has struggled hard to give it a greater sphere of action in Germany. His success at home was only limited, but other countries have adopted his ideas and use his apparatus in their armies. For instance, Holland, Russia, Spain, Belgium, etc.

The value which the Americans laid on the maintenance of their telegraphic communications is shown by the fact that General Hooker detached one regiment exclusively† for patrolling the line between "United States Ford" and Falmouth. The soldiers had orders to shoot any one attempting to damage the telegraph.

The telegraphists and workmen of the Military Telegraph Corps were exempt from military duties. Many of them were, nevertheless, forced to enter the army and were frequently ordered back as soldiers for the military telegraph service. The United States Government demanded from every telegraphist an oath of fidelity of service.

Notwithstanding their important and confidential position as cipherists, which brought them into close connection with the commanding officers, they held no military rank. This fact gave rise to much unpleasantness, such as denying the operators a place at the officers' mess, ranking them with orderlies, &c. Under these conditions the unfriendly feeling could not fail to assume at times such proportions that the success of the armies became endangered. Well-meant attempts to gain for the corps a military organization were repeatedly made by the men and their chiefs. The War Office received these proposals, acknowledged the value and enthusiasm of the corps, and its anomalous position, especially of those working at the front, but made no alterations. Mr. Stanton, Secretary of State, considered that the military telegraph acted more independently and effectively under the exclusive command of its civil officials than it could do if officers and men had military rank, which would place them invariably under the command of the officers of the army. Stanton was of opinion that this should be especially avoided. This decision of the War Office was the cause of the commencement of the first complaints of the military telegraph corps, which up to the present day has received no proper redress. If President Lincoln and Secretary Stanton had lived, the services of the military telegraphists would have been acknowledged and rewarded at the close of the campaign. When, however, the leading statesmen changed, the sacrifices and claims of the military telegraphists were completely forgotten, and this civil corps, organized in the hour of need, without the warrant of Congress, had not even the right to demand a recognition

* Let us show the importance of cryptography by relating one of the numerous cases which occurred. On a line that connected Grant's headquarters with Fortress Monroe at the time of the advance against Richmond, Operator Charles Gaston, of General Lee's corps, was sent out, accompanied by a few soldiers disguised as woodcutters, to connect his sounder with the enemy's line in the neighborhood of Sassey Court House, in a wood. For this purpose an insulator was prepared that would hold both ends of the wire when cut, without visibly differing from the other insulators. From this two fine silk-covered wires were led under the bark of the post to a short distance into the wood and covered with grass. The disguised soldiers kept watch whilst the operator was in direct communication with City Point and the enemy's War Office. Gaston, without telegraphing himself, remained for six weeks thus connected with General Grant's lines. This incident shows what an expert and intelligent telegraphist can do in time of war; but it likewise proves that the interception of messages is quite harmless if sent in cipher. Although Gaston received patiently for six weeks all the enemy's telegrams, only one was comprehensible to him, for only this one was not transmitted in cipher. This telegram, intercepted on September 12th, 1864, was the cause of the capture from the Federals of a transport of 2,486 oxen, 200 mules, 300 soldiers, 40 telegraph workmen, and 32 laden transport wagons.

* For instance, when reconnoitering the town of Farrington, led by Operator Parsons and accompanied by a cavalry company under Captain Smith, the telegraph line of 6.5 kilometers was erected by the cavalry. The troops were attacked, and a great number of men were taken prisoners. Parsons telegraphed under fire whilst he was slowly retreating with the rest of the troops, thereby keeping up telegraphic communication with head quarters.

† On February 17th, 1864, S. N. Palmer, General of Brigade, reported as follows to Major-General B. F. Butler, then commanding Virginia and North Carolina: "General . . . . . Extract.—At no time, I suspect, during the present war has the utility of the Military Telegraph and the Signal Corps been more fully demonstrated than during the late attack. The attack had scarcely commenced at the outposts when the telegraph had not only informed me of all that was going on in front, but the whole line of posts to Morehead was put upon its guard, and during the day, when the enemy were immediately around the town, the Signal Corps kept us advised of the smallest movements of the enemy at any point of the line. I cannot think too highly of these two corps."

The Discovery of Electro-Magnetism.

By Dr. D. Tommasi.

To whom belongs the honor of this beautiful and fruitful discovery, the applications of which, no less numerous than varied, cause it to be justly considered as one of the most brilliant and most useful conquests of the human mind.

Most physicists, not to say all, do not hesitate to regard Oersted as being the true and only author of the discovery of electro-magnetism, and yet this has not yet been established in a definite and indisputable manner. It seems, in fact, to result from researches undertaken in 1859 by Zantedeschi that the true creator of this new branch of electricity is an Italian, Romagnosi. But notwithstanding all his authority, Zantedeschi has not succeeded in causing his ideas to be adopted, and all the efforts which he made with the view of claiming for Italy the honor of the discovery of electro-magnetism have been absolutely fruitless.

The arguments by which Zantedeschi supported his view are not devoid of all foundation, as will be seen from the following article, published by an Italian journal in 1802; that is to say, seventeen years before Oersted discovered the deflection of the magnetic needle by the current of the battery. In the *Ristretto dei Foglietti Universali* of Trieste, of August 3d, 1802 (quoted by F. Hoefer in his *Histoire de la Physique et de la Chimie*, p. 298), we read: "Councillor Giovanni Domenico Romagnosi, of Trieste, hastens to communicate to the physicists of Europe an experiment relating to the galvanic fluid applied to magnetism. After having made a Volta's pile with discs of copper and zinc, between which were interposed circles of flannel saturated with dilute ammonia, the author attached to the pile itself a silver wire broken in different places like a chain. He then took an ordinary magnetic needle disposed in the manner of a naval compass and let into a prismatic axis of wood. After having removed the glass cover, he placed the needle upon an insulator of glass, close to the battery. He then seized the chain, taking it by the glass tube, and applied its end to the magnetic needle. After a contact of some seconds, the needle deviated several degrees from its polar position. On removing the chain the needle preserved the direction thus impressed upon it; on applying the chain anew the needle again deviated a little and preserved the position in which it was left, so that its polarity seemed entirely destroyed. M. Romagnosi to restore it proceeded as follows: He pressed with both hands, between the thumb and the fore-finger the edge of the insulated box, but avoiding any shaking, and held it for some moments. The needle was then seen moving slowly and resuming its polarity, not all at once, but by successive pulsations, like the second-hand of a watch. This experiment was made in the month of May, and was repeated in presence of several witnesses."

In conclusion, he asks, "Is it to Oersted or to Romagnosi that we should ascribe the merit of having first observed the deviation of the magnetic needle by the action of the galvanic current?"

"Had Oested any knowledge of the experiment of Romagnosi when he published his discovery of electro-magnetism?

"Have any other *savants* taken part in this discovery?"

The author submits these questions in particular to the Managing Committee of the Vienna Exhibition, in the hope that they may be brought before electricians.

A Fatal Wire.

The case of N. Frances Crones *vs.* the Western Union Telegraph Company was filed recently in the United States Circuit Court at San Francisco, Cal., on transfer from the Superior Court of Los Angeles County. The action is to recover $25,000 damages for the death on the 8th of last January of Felix H. Nickerson, a son of the plaintiff. The company is alleged to have negligently allowed a wire to hang about eight feet above the public road, about one-half mile north of Compton, and that on the 6th of last January, while driving along the road, one of the deceased's horses became frightened, and he was knocked off the wagon by the wire, and received injuries resulting in his death.

The Electric Light in Arizona Mines.

A number of mining companies in Arizona Territory are about to adopt the electric light to facilitate operations under-ground, as well as on the surface, notably the Silver King Mining Company, the Howell Smelting and Mining Company, and the Conger Mill and Mining Company. At the Silver King Mine it is proposed to use four 3,000 candle-power Brush lights above ground and two below, together with twenty-five small incandescent lamps. The dynamo located near the main shaft will supply the current descending 800 feet to the lower levels of the mine to the arc lights and storage boxes, from which latter the Swan lamps are to be connected by small copper wires. Fixed lamps are to be suspended from the roofs of galleries, and the portable lights are to be attached to flexible conductors for convenience of shifting. These lights are to burn continuously, night and day. In the reduction works of this company both large and small lights are also to be used, a separate dynamo and two storage batteries supplying the current. The arc light circuit in the Silver King Mine will be about half a mile in length.—*Arizona Citizen.*

At the Exhibition of Engineering and Metal Trades in England, the Leeds Forage Company have built a novel exhibit, which has attracted much attention. It is a boudoir made of corrugated iron, of which the London *Times* speaks as follows: "It is lighted from a storage battery, in another part of the boiler, with miniature electric lights. The lighting from a storage battery is as successful as it is pleasing in effect, and it is striking, moreover, as showing the progress which is being made toward independent house-lighting from storage batteries."

A company, with a capital of $100,000, has been organized to introduce the electric light at Columbus, Ga.

Successful Electric Lighting.

Of the older electric light companies much has been written and said in our columns during the past year or more. Their success as parent, local or construction companies have been chronicled in the daily and weekly press all over this broad land, and especially wherever a local organization had been started. Their system was thoroughly and carefully expounded by them, and eagerly read by an anxious public, only too willing to take any light found to be superior to the unhealthy, foul-smelling gas. From a sanitary point of view, nothing has yet been written upon this important subject that does full justice to the case. Whether we shall consume, so to speak, electricity in furnishing a healthful light, or have a poor illuminating, nauseating-smelling gas consume us, is a question of vital importance to ourselves and our posterity, and one that will sooner or later command the attention of the thinking public, as it deserves. Important beyond comprehension at the present day is this one question, and when public sentiment is well aroused it will be sensibly apparent that the future of all electric lighting is solved without regard to cost. The people have progressed in the latter respect very materially since the first introduction of the electric light, and take a broader and more liberal view than they did in the beginning, and as a natural consequence electric lighting is on a firmer basis to-day than ever before. The progress has not been alone upon the public's side of the question. The patient work of the inventor's brain has discovered new methods of overcoming difficulties; and the untiring energy of many men in properly introducing these various systems to the public would fill many columns of this journal. Of one company that has made marked progress in improving their dynamic machinery, from which many good results are attained, we spoke of at length in our issue of June 14th. The addition of an automatic current regulator to the other excellent features of the Thomson and Houston electric light system makes it one of the most suitable now in existence. The favor with which it is received wherever tried more than confirms us in this opinion. In conjunction with this company, the American Electric and Illuminating Company, of Boston, have been very successful in introducing this excellent system of electric lighting throughout New England.

An outline of their work will be of interest to many of our readers not familiar with the organization of and methods of this company. The American Electric and Illuminating Company was organized in the summer of 1882, and is only about one year old; but through energetic work of Mr. Edward H. Goff, its president, it has made phenomenal progress during that short period. Having no system of their own, they made thorough investigation into the many then in existence, and selected with shrewd common sense the best, and have been using the Thomson and Houston system from the beginning. Their work at first was that of a parent company, but as they progressed it was apparent that it must necessarily assume the character of a construction company, which is, after all, an equal division of labor in properly introducing any work of magnitude to the public. The manufacturer must have no distracting cares or minor details to look after. His mind must be solely upon the perfection of the machine or article in all its details. The buying of engines, furnaces, wires, and other necessary material, employment of men and location of plants, and, if need be, running them, under the natural order of things should come under other minds and management than those of the tormented and often confused brains of the inventor. Mr. Goff has managed his part of the work eminently well. His company buy the complete apparatus for an electric light plant from the inventors and manufacturers, select the city, town or mill, locates the plant, buys the engines and boilers for the power, and rent the building, secures whatever franchise or permits that are necessary from the officials or owners, organizes local companies and puts the whole system in operation, complete in every detail. Under this arrangement remarkable success has been attained, and the most healthful electric light been produced, paying plants established, and dividends paid from the profits of this business, which has been in operation much less than one year.

Now, let us briefly examine the wonderful progress which has been made in that period. We quote a press report published in the Boston *Herald*, July 1.

First, there is the Boston plant, which runs 350 lights in various parts of the city—in stores, halls, streets, squares, and lastly in the Public Garden.

The first commencement here was humble enough—only one engine and dynamo and a few lights, and has grown and grown, until there are now 5 engines and 20 dynamos of large capacity running the number of lights named.

And here, perhaps, it may be as well to give an outline of the policy pursued by Mr. Goff in extending the system to other cities. After the experience he had in starting his own company here, he saw what a poor prospect there would be of inducing people in other cities to subscribe money to start an electric lighting company, no matter how bright the prospects might be. His success in Boston brought him abundant means, and the company being thus forehanded, he determined that wherever there was a call for the light and the prospect of a paying business, he would establish a lighting station without calling upon anybody in the place to subscribe a single dollar, trusting that the success he might achieve would induce the people there to in time form a local company.

The first call came from Lowell in January last, and, after a good deal of skirmishing and opposition from rival interests, a plant was established in that city, and the lights furnished gave such satisfaction that they were rapidly increased, and the business assumed a phase where capitalists saw clearly it was going to pay, and, accordingly, the Middlesex Electric Light Company was formed, and the lights furnished by this company soon multiplied to the number of 100—now being increased to 150—and by the 1st of January next it is anticipated that the company will have 200 lights in operation This company rents its steam and has two 50-horse power Armington and Sims engines.

Next we have the Fitchburg plant, the new station containing which was opened on Wednesday last. This is now owned by the Wachusett Electric Light Company, and runs 100 lights. The lighting was started at this place by in the same way as at Lowell, and the new company has been formed to operate it. This company built its new station, evidently having faith in the future of its operations. Indeed, its present number of lights it to be increased to 150. The engine in use in this station is a Fitchburg 75-horse power, and the foundations and attachments are in for another of the same size and make, which would give an available capacity of 150-horse power double engines. There is in the new plant a 100-horse power boiler, with a Jarvis patent furnace.

Next we have the Hartford (Conn.) plant; and here the skill, tact and diplomacy of Mr. Goff, with good will of Mayor Bulkely, and other Hartford gentlemen won an important advantage. The right to stretch wires for electric lighting had already been ceded to a local company—the Hartford Electric Light Company—and with this association Mr. Goff united, the result being a consolidation of interests to the great advantage of both parties. This company is now in successful operation, running 100 lights, and there is room for 100 more. The company uses 2 50-horse power engines of the same make as those in the Lowell plant, and hires its steam from the Hartford Steam Company. This makes in all 650 of the American Company's lights now in actual operation—a grand showing for an eight-months' business.

But, after all, it is not so surprising when the causes of this growth—for growth it is—are taken into consideration. There was, to begin with, a good light. Then there was no branching out beyond the means at hand—hence there was no troublesome debt hanging over the heads of the management. Then there was a well-considered and sound system of action decided upon and adhered to through every vicissitude. These were backed by a courageous policy and conservative methods. There could, of course, be but one result, and that success. There are now several plants under construction. The first of these in importance is the 200-light plant in Providence. The premises engaged for this purpose occupy the whole ground floor, 80x100 feet, in a new building next beyond the skating rink. A boiler house 40x45 feet has just been erected near by, from which the steam power needed will be supplied. The work of fitting up and equipping the station is now in progress, and the company expects it to be ready for occupancy about the middle of July. The plant will consist at the outset of two 100-horse power boilers with Jarvis furnaces, four high-speed 50-horse power engines, made by the Armstrong & Sims Company, and eight large Thomson-Houston dynamos of 25 to 30 light capacity each, with lamps, etc. At Cottage City, Martha's Vineyard, there is a plant in successful operation. It consists of one 50-horse power boiler and an engine of the same capacity. Fifty lights will be supplied the present season, and it is expected that in the coming season 100 lights will be demanded. At Old Orchard Beach there will be erected a station equipped with a 50-horse power boiler and engine of equal capacity, and 50 lights are to be run. If sufficient custom is guaranteed this summer. 100 lights will be run there next season. Mr. Goff closed a contract with the Ocean Pier & Steamboat Company, and is putting in two 10-light machines at Ocean Pier, Revere Beach. In addition to the above, there are to be new companies in the following cities: In Worcester, Mass., with a 100 or 150-light plant; in Springfield, Mass., with a a 100 or 150-light plant; in New Haven, Conn., with a 100-light plant; in Bridgeport, Conn., with a 100-light plant. The above cities are to be lighted by the Thompson and Houston systems, constructed and operated by the American Electric and Illuminating Company, except where local companies are now under organization, with prominent local capitalists taking a large portion of the capital stock. In addition to the above, it may be stated that a charter is now being prepared for a company with a capital of $1,000,000 to light New York City. Several prominent bankers will invest heavily in the enterprise. Mr. Goff's ambition is to make the New York plant the largest and most complete arc lighting plant in the world. There is also to be a Boston company, which is now in process of organization. It is to be called the Merchants' Electric Lighting & Power Company, and is to start out with a capital of $500,000. The American Electric and Illuminating Company will turn over its entire lighting plants to the new company, with lines, structures and fixtures, taking its pay for the same in the capital stock of the new company, the balance remaining to the new company to go into the treasury, to be disposed of for enlargement and further development. Strong local capitalists will form the new Boston company, and it is believed that this new company, with vigorous management, can put in lights enough during the next twelve months to bring its capacity up to 1,000 lights. In this connection it may be said that Professor Thomson is now at work on a new electric motor, which will, when perfected, be employed by the company to supply power wherever needed. Professor Thomson is also perfecting a system of different-sized arc lamps, viz., one-half, one-third and one-quarter sizes—a very important departure in electric lighting, for there are many who would use the arc light if it were less intense, as these smaller lights would be, and could be obtained at a cheaper rate than the larger lamp. With the sale of its plant in Boston, the American Electric and Illuminating Company goes out of the business of electric lighting directly, and becomes a parent company and a construction company for New England and New York State, having secured the exclusive right for the Thomson-Houston system of electric lighting the above named Territory. Besides, in fast engines, patent furnaces are used, which will readily burn the cheapest fuel. This would insure a minimum expense in the matter of fuel, which is the great desideratum in doing an electric lighting business profitably.

Here we have, in an active work of only eight months, a wonderful series of evolutionary occurrences. It is a growth and an extension, it is safe to say, without parallel even in the annals of rapid growth of stock companies. It would seem as if it could hardly be out of its swaddling clothes when, lo! it retires to the dignity of a mother company, and a prolific one at that, as can be easily understood after looking over the list of minor companies already organized, and in operation, and about to organize.

The annual meeting of the stockholders of the company was held on June 30, and the following named directors were elected for the ensuing year:

Silas Gurney, proprietor of the Tremont House, Boston; Alderman C. S. Haldeman, of Boston; William A. Hovey, late editor of *Manufacturers' Gazette*, Boston; Dr. J. G. Graves, Nashua, N. H.; Henry Colony, of Colony Bros., woolen manufacturers, Keene, N. H.; Chas. B. Whiting, of C. B. Whiting & Co., bankers, Worcester, Mass.; C. D. Smith, Boston; George A. Carter, American Express Company, Saco, Me.; Colonel H. M. French, Boston; William E. Hodgkins, of Charles A. Smith & Co., Boston; Edward H. Goff, Boston.

On the following Tuesday the above named directors met and elected the managing officers of the company from their board: Edward H. Goff, President and General Manager; Silas Gurney, First Vice-President; William A. Hovey, Second Vice-President; H. E. Irvine, Treasurer; Samuel Elder, Secretary; C. D. Smith, General Superintendent of Construction.

The management state that they have so far matured plans for the coming 12 months that orders for the necessary supplies have been placed with the manufactories to supply engines, boilers, dynamos, lamps and copper wire to equip the following plants in addition to those already mentioned:

250 lights additional in Boston, making a full 600-light plant in that city; 100 additional in Hartford, Conn, making a 200-light plant there; 50 additional for Cottage City, Martha's Vineyard, making 100 there; 50 additional for Old Orchard Beach, Me., making 100 there; thus aggregating 550 additional lights for plants already established.

For new stations now under construction or to be established during the coming year: 300 for East Boston, Chelsea, Malden and Revere Beach, with central station at Chelsea; 100 for Cambridge and part of Somerville, 100 for Lawrence, 100 for Nashua, N. H., 100 for Manchester, N. H., 100 for Saco and Biddeford, Me., 100 for Portland, Me, 100 for Lewiston, Me, 100 for Augusta, Me., and 100 for Bar Harbor, Me, making an aggregate of 3,400 lights in central stations, besides several smaller stations talked of and a number of isolated plants for mills, shops, &c. The material required will be about 150 25-light dynamos, 75 50-horse power engines and at least 600 miles of copper wire.

In reproducing this summary it gives us pleasure to add our hearty approval of the system under which Mr. Goff conducts the various local plants and the careful personal attention he gives to the smallest details and his pre-eminent ability as an organizer and his careful business methods.

Hotel Clerk—"There is a newspaper man who has been stopping with us during the week, and he has just called for his bill. If we are liberal with him perhaps he will give us a good notice." Landlord—"A capital idea. Tell him there will be no charge." Clerk—"Yes, sir." Landlord (calling clerk back)—"Anybody with him?" Clerk—"Yes, sir; his wife." Landlord—"All right; charge her double rates."—*Boston Transcript.*

Line of Telegraph Through an American Forest.

(*Translated for the* ELECTRICAL REVIEW *from La Lumière Electrique.*)

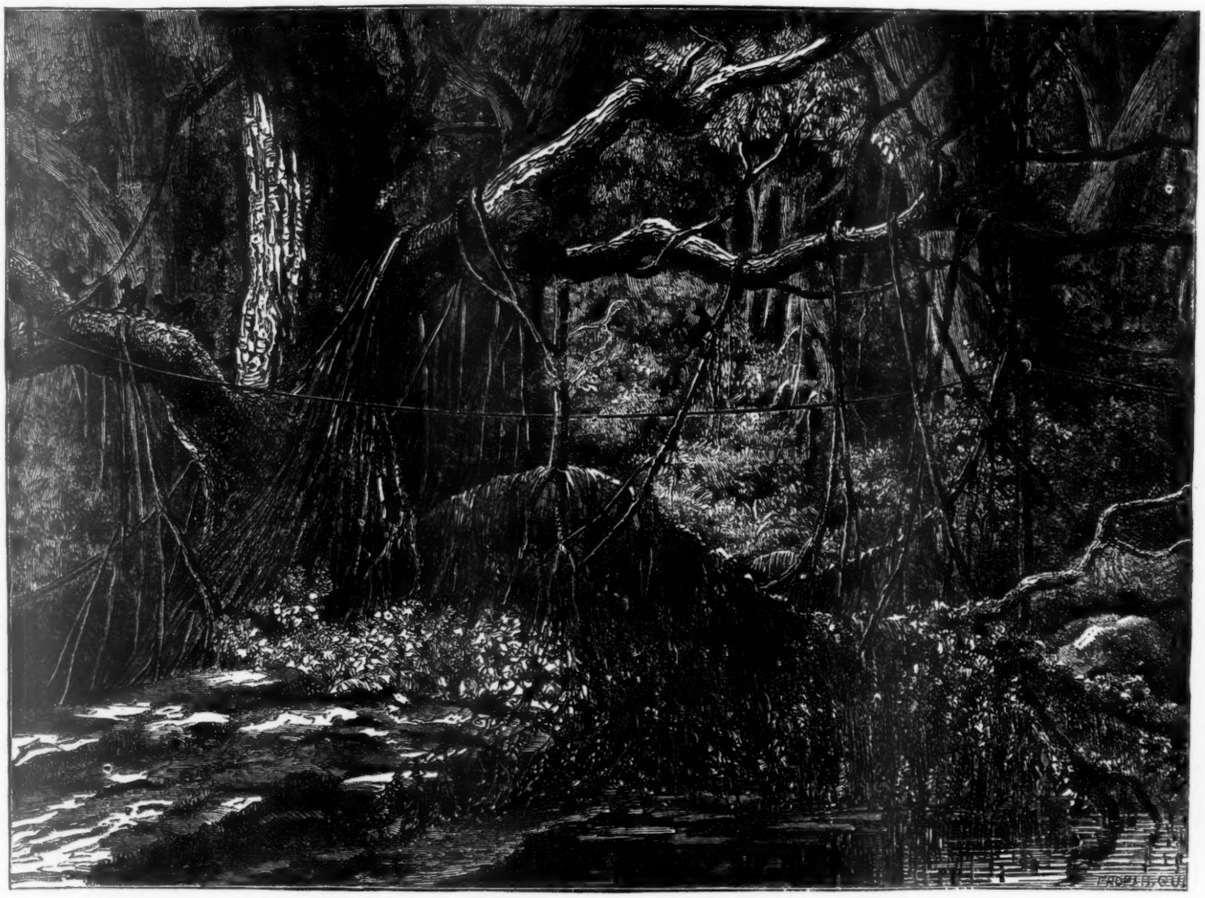
The inhabitants of the New World are, above all things, practical people, to whom may well be applied the words of the English adage, "Time is money." So in all the great enterprises of public interest, the principal object is to get to one's destination quickly, without considering the perfection of the work, and sometimes even forgetting the elements of safety. The lines of railways and telegraphs are a proof of this. These great industrial undertakings do not belong to the Government of the United States, neither are they conceded with rights of monopoly to powerful companies; it is a private industry, which must submit simply to the laws and ordinances for the establishment of these lines in cities, on public highways, on public buildings and on private property. In the case of railways, everything has been suppressed which could be an inconvenience or a cause for delay in the work of construction; the track is perfectly free of access; there are no hedges, enclosures, nor barriers, and therefore no need for employes to open and close the gates at level crossings; in all the places where a highway crosses the railway, a sign-board is displayed, bearing these simple words, "Look out for the Locomotive." The public is forewarned and people habituated to take care of their own safety, in place of being held in leading-strings as in France or of being herded in folds like a flock of sheep, under the protext of protection. In the streets of cities or of villages where there are stations, numerous instances of skillful navigation occur continually, and I remember often having seen a crowd of urchins running after a train to steel a ride on the last car, as they do here to jump up behind on vehicles drawn by horses; notwithstanding this absolute freedom from restraint we do not find any great number of accidents from this cause recorded. There are sometimes great catastrophes arising from insufficiency in the engineering department, but at this date the supervision is carried on in a much more perfect manner, and one can enjoy as much security in the railway trains of North America as in those of old Europe where routine and excess of precaution maintain a great number of vexatious regulations.

For telegraphy in the United States there exists an organization somewhat similar to that for the railroads; since the year 1845 this service has been placed at the disposal of the public generally, the Government abandoning the general exploitation to public competition, reserving to itself only one or two wires on the lines then completed. Telegraphic communication has reached an immense development—thanks to the rivalry of the different companies the lines are everywhere multiplied, the apparatus is improved every day, and any invention which seems to offer a greater rapidity of transmission is immediately experimented with and soon adopted if it gives favorable results.

We see, therefore, that the exploitatian of telegraphic communications is, like that of the railways, a private industry, exploited by numerous companies which are dependent upon in no respect, in their administration, the general Government or that of the States, and who can in many parts of the American Union organize without any sanction from the public authority. The Constitution of the country gives entire liberty to individual citizens, or to corporations to install, in certain States, electrical communications on the sole condition that they shall submit to the laws and ordinances for the establishment of such wires in inhabited localities.

Telegraph lines in America are far from being constructed with the same care as in Europe, for it is more important to establish communication between two distant places as rapidly as possible, rather than to do it well. The American lines are nearly everywhere formed of aerial wires; and this system still exists, even in the large cities, notwithstanding the serious agitation which has arisen on the subject, for several years past, of adopting subterranean cables. Consequently the surface of important cities seems covered with an immense spider's web, in consequence of the thousands of wires which cross each other in all directions, on the poles destined to hold these wires stretched through space. These poles are not, as in Europe, fine masts of fir, well seasoned and carefully impregnated with pyrolignite or other salts, but simply any trees whatever, scarcely even trimmed In the cities these poles are very tall, and although very solidly fixed at the edges of the sidewalks, they frequently fall under the powerful strain of 15 or 20 wires swayed by a violent wind. During my sojourn in New York, I saw one of these poles lying across a street and which had killed an unfortunate passer-by in its descent. Outside of the cities, the telegraph is placed on the sides of the railways, on the sides of highways, canals or rivers, and no difficulty causes any delay, nor is any obstacle allowed to arrest an installation once commenced.

If the route of the line encounters one of those immense virgin forests of which the hand of man has never yet touched a branch, the work goes on all the same; long spikes are driven in the trunks of trees, and to their curved ends are fastened glass or porcelain insulators on which the wire rests, and the telegraph line pursues its way through entangled vines, thick underbrush, the trunks of century-old trees (see our illustration) visited only by various monkeys, very much astonished no doubt to see some fine day a human creature appear in the uniform of the telegraph lineman. This lineman, lost in the middle of these immense spaces, is not, however, completely isolated, for at any point whatever he can correspond with any office on the line by means of an extremely ingenious little apparatus called the pocket-relay, which was described in 1882 in the number of *La Lumière Electrique* for April 29. It is well known that this apparatus consists of an electro-magnet laid in a sort of oblong ebonite box, with a key and relay; to be used, it is only necessary to connect one of the screwposts to the line and the other to the earth; the whole apparatus is about 5 inches long and 2 inches wide, it is thus easy for the lineman on duty to notify the nearest office on the line of any serious deterioration which he may encounter, and to ask for any materials and assistance necessary to make the required repairs. On account of the rude character of the installation through the forests of America there are frequent interruptions of communication; trees rot and fall, violent winds and the terrible storms sometimes prevailing in these countries prostrate the wires over a greater or less extent of territory, and the visits of the repairmen then become indispensable.



LINE OF TELEGRAPH THROUGH AN AMERICAN FOREST.

In the portions of the country where the population is more compact brigades of repairmen are stationed at proper distances apart, sometimes at a distance of about 100 miles from one to the other; but along the routes of lines which are attached to trees through the forests, it has been found prudent to place the stations at distances not greater than about 20 miles apart.

The electric telegraph companies, having entire liberty to select any system, the most diverse forms of apparatus are in use in the United States, according to circumstances; three systems are nevertheless most generally adopted, the Morse, that of Alexander Bain and that of House; the first is in use on the larger number of the lines.

In consequence of the immense extent of the American Continent, the lines are often the property of several companies, and transmission is subjected to annoying delays every time that it is necessary to re-transcribe a telegram; but when the distance to be traversed, although considerable, is reached by the lines of the same company, the service is performed with an accuracy and rapidity that the European administrations in general, and that of France in particular, would have to search a long time for to obtain.

C. C. SOULAGES.

Telephonic.

[For the REVIEW.]

The Telephone in Louisville, Ky.

From Nashville, Tenn., to Louisville, Ky., the distance is about 184 miles, over the Louisville and Nashville Railroad. Close along the line of the road the country is formed, and seems to be a fine agricultural and pastural district, while woodland prevails further inland.

One of the modern world wonders is located in this region, and brings more visitors in a week than would otherwise be seen in a year. This, it need hardly be stated, is the celebrated Mammoth Cave of Kentucky.

The "cave," as it is called in the surrounding country, is reached by stage from Cave City, a station on the before-mentioned railroad, 100 miles from Nashville. Cave City is a city only in the Pickwickian sense, and consists of a station and telegraph office, a hotel, two ale-houses, a drug store, a general country store, a blacksmith's shop, and about thirty dwelling houses. After having spent one night there, and consuming a breakfast and a supper, your correspondent can conscientiously recommend the Cave City hotel; for broiled chicken, fresh eggs, corn cakes, excellent tea and coffee, were here to be found in abundance, and though the sleeping rooms were small and sparely furnished, they were clean.

No sane person can, however, approve of the stage ride between Cave City and the cave. It is said to be a distance of ten miles. To the sufferer it is apparently nearer ten leagues, over the most abominable road in the world, not even excepting Kentucky. Stones, rocks, corduroy logs, combined in this road to add their dismal effect and to dismay the passenger. I have been on the Atlantic in a storm; I have crossed between Kingston, Ont., and Cape Vincent, N. Y., in a sleigh, over hummocky ice; I have rode on a locomotive forty miles an hour over the most circuitous railroad in Connecticut, and I have traveled for miles in an unspringed cart over the mountain roads of Wales, but until this memorable time my experience was evidently incomplete.

There can be nothing in the matter of rough riding to be hereafter revealed, for the Kentucky stage ride capped the climax, attained the acme of concentrated depravity, and piled Pelion upon Ossa.

But the longest day has an end, and in due time the cave was reached, and after paying three dollars for the privilege of entering, buying a cane frescoed by the natives and costing ten cents, the initiation took place. A party of nineteen was formed, fully half of whom were young ladies, and under the guidance of "William," the guide, the exploration commenced.

It is not my intention to describe the oft-described Mammoth Cave. It suffices to say that we groped from nine to ten miles underground; that each of us carried a lamp; that at certain well-defined places "William" told us the name of the locality, and frequently got off some horrible pun or threadbare joke, which, from its easy delivery, had evidently been delivered diurnally by "William" for the last twenty years; that we looked up into a great many domes, and down into a great many bottomless pits, the most bottomless of which was 158 feet deep; that at the Star Chamber all lights were put out, and we gazed up and saw what was apparently a multitude of stars on a dark background of sky, but which really was an infinity of crystals on a background of oxide of manganese; that we inspected the Dead Sea; scanned the River Styx; dragged ourselves through Fat Man's Misery, and that ultimately we climbed through a rocky, difficult and tortuous crevice, known as the corkscrew, and found ourselves within a short distance of the mouth of the cave, having, by passing this corkscrew, saved, so said our guide, three miles.

Yet we had consumed four hours of precious time, having entered the cave at 10 A. M., and left it at 2 30 P. M. A strong blast of cool air steadily rushes from the mouth of the cave into the open air during the summer, and it is said that the current in the winter is reversed, and blows into the cave. After a good dinner the return to Cave City was endured, and by 11 P. M. we were once more on the way to Louisville, where we arrived about two o'clock the next morning.

Louisville, the commercial metropolis of Kentucky, is the greatest tobacco market in the world, and has a population of 124,000.

It is favorably located on the Ohio River, at the head of the falls, and is therefore frequently designated as the "Falls City."

Just across the Ohio, in Indiana, is the city of Jeffersonville, boasting a population of 10,422; while also on the Indiana side, but three miles lower down, and opposite the Louisville suburb of Portland, is New Albany, a city of 16,422 inhabitants.

This cluster of cities and the surrounding territory constitutes the telephone exchange system of the Ohio Valley Telephone Company.

This company is the successor of the American District Telegraph Company, and has the following organization: Jas. B. Speed, president; W. H. Mundy, secretary; James Clark, treasurer; H. N. Gifford, general manager.

The executive offices of the company and the principal central office are located in the Board of Trade Building, corner of Third and Main streets, where also is the Western Union Telegraph office

In addition to the regular subscribers' lines, which radiate from the Louisville central office, there are three lines to New Albany, three to Jeffersonville, and four extra territorial lines, *i. e.*, one to Anchorage, Ky.; one to Shelbyville and Frankfort, Ky.; one to La Grange, Ky., and one to Frankfort direct.

It is intended shortly to build a line from Louisville to Cincinnati.

There is an extensive out-of-town business, chiefly, however, with New Albany and Jeffersonville.

The central office at Louisville is, as usual, in the sky parlor of the building, but has been made as comfortable and home-like as possible, the walls and ceiling being æsthetically adorned with the most stylish paper-hangings.

The switch-board consists of sixteen fifty-line sections of the Gilliland pattern, which has been now in use for over two years. It is found, however, that the business is rapidly outgrowing its facilities, and as soon as the ideal switch-board is produced, it will be wanted at Louisville.

This board accommodates 800 subscribers' lines, and is nearly full. About two-thirds of the entire number are lines having but one subscriber's station, and the largest number on any line is five. This occurs but rarely, and the management is in favor of one-station lines altogether.

There is a force of twenty-nine operators, of which three are extras and two are on duty all night. The operating department is managed by Mr. Samuel W. Russell, a gentleman of large experience in such service.

Most of the operators are ladies, and two young ladies also officiate in Mr. Gifford's office as clerks and stenographers. Upon entering this office, the stranger's first impression is that Mr. Gifford chooses his young lady assistants on account of their personal attractions, both being liberally endowed in this respect; but after becoming better acquainted with the City of Louisville, it is soon found that Mr. Gifford cannot help himself in the matter, since all the Louisville ladies are handsome.

The system for receiving complaints in the central office is worthy of note. A young man bearing the somewhat distressing title of "the trouble clerk" sits at the end of the switch-board, with suitable record books. When a complaint is received, it is at once turned over to him, recorded, and given to the proper inspector or lineman.

It may be presumed that more phosphor-bronze line wires are here in use than in any other city, and they give great satisfaction, being very light and practically unoxidizable. For short lines they seem well adapted.

Aerial cables have not, as yet, been greatly used, the only one at present being a home-made one of 100 wires, which answers very well.

The subscribers are increasing at the rate of about ten or twelve per month.

For calling purposes, one large magneto generator driven by a water motor is found sufficient during the day, and a pole-changer and battery of twenty-one cells is used at night.

A specialty of this exchange is the great attention which is uniformly paid to ground wires. Large copper wires run in every direction, for central office main grounds, for lightning-arrester grounds, for generator grounds, and for subscribers' lines, and to the excellence of this feature the clearness and loudness of the transmitted speech and the immunity from lightning troubles enjoyed here is directly attributable.

The cashier's department is supervised by Mr. Albert Schlicht, a gentleman whose urbanity is only excelled by the deep sonorous smoothness of his voice, which is one of the most delightful basso-profundos imaginable. It was really quite a lesson in acoustics to hear Mr. Schlicht answer a telephone message.

Louisville will rise into increased importance during the coming autumn, by reason of the Exposition, which is to be opened in August.

The building, which is now nearly finished, equals in superficial extent the main Centennial building, and will be lighted by the incandescent electric light.

It is the hope of the writer that, before the exhibition closes, business may once more call him to the city of the falls, that he too may enjoy the glories there to be displayed.

PSGOASSH.

An Ingenious Thief.

A telephone operator who reads "How to Shine in Society," and does—a curiously depraved taste for literature, cards, tooth-brushes, pocket-books, &c., &c.

A curious burglary was committed in Yonkers on Friday night. For the past two or three months Jerome Kollmar, seventeen years of age, has been the night operator for the Westchester County Telephone Company, whose central office is on Main street. Miss Adelia Adgate is the manager of both this and the Western Union Telegraph office, Kollmar serving under her. At 9.25 o'clock on Friday night Miss Mary Anderson, the assistant telegraph operator, locked up the office, which is under the Getty House, and went away, leaving $52 in cash in the money-drawer and a check for $50.70. Some fifteen or twenty minutes before she locked up, however, Kollmar came in the office and seemed very inquisitive in looking around. At 12.40 o'clock the same night, or yesterday morning, the Telephone at Police Headquarters rang, and the Sergeant went to the instrument. There he was informed by Kollmar, who was at the telephone central office, that he thought there must be something wrong at the Western Union Telegraph office, as their signal had dropped down and he could not call up any one over there. Furthermore, it was dark in that office, which gave the matter a suspicious air. The police at once went to the telegraph office, which they found locked and dark, as represented. Miss Adgate was summoned, and when she arrived and opened the door the money-drawer was found broken open, the money gone, and the place thoroughly ransacked. On the floor was found a screw-driver which the lady recognized as belonging to the telephone company. The police also discovered that whoever had perpetrated the burglary had got in through a little hallway leading from the wash-room of the Getty House. The catch on the door had been pulled aside by means of a piece of bent wire, which was also found lying on the floor. Captain Mangin then went to Kollmar, to whom the latter told a straight story, but when confronted with the tell-tale screw-driver, he was at a loss to account for it and tried to "get around" it. Miss Adgate then had a talk with the young man, and she got him so closely cornered that he confessed to her that he had committed the burglary, and that he had an accomplice in the person of another young man, named Howard Kraft. Kraft was subsequently arrested, and although Kollmar affirmed when confronted with Kraft that he was with him, the latter stoutly denied all knowledge of the burglary. Kollmar then told Captain Mangin where he had secreted the money, and went with him to Nodine Hill, where it was found done up in a paper in some bushes.

Upon going to Kollmar's home and searching his trunk, the police found the proceeds of numerous burglaries upon the store of Jacob Scherpe, which adjoins the telephone office. Among the goods found in this trunk and identified by Mr. Scherpe as his property, were three Allen 22-caliber nickel plated, pearl-handle revolvers, one pearl handle Victor pistol, a toy pistol, a harmonica, five fancy ink-stands, three chain knives, five pen-knives of different kinds, three bone toothpicks, five boxes of fancy writing paper, a box of gold-colored paint, three Russia-leather memorandum books, two sets of dice, fifteen rubbers of different kinds, a pencil sharpener, a large bottle of black ink, one bottle of violet ink, one box of pins, one bottle of white cement, one box of steel pens, one box of carmine ink, three books—"Chesterfield's Letter Writer," "Allison's Hand Lexicon," and "How to Shine in Society"—a pack of playing cards, two picture frames (in one of which was Mrs Scherpe's picture), two ladies' pocket books, three tooth-brushes, a lot of lead pencils, two fountain pens, an assortment of artists' pencils, a few hundred scrap-book pictures (colored), and a good many other things, all to the value of about forty-five dollars.

Mr. Scherpe said he had not missed any of these things. For the past six months the citizens have had a good deal of trouble in calling up the telephone central office at night. It is now supposed that the reason for that is that the night-operator was off on some of these little burglary excursions to Mr. Scherpe's, as the goods were taken piecemeal, a few at a time. The two youths were held for the action of the next Grand Jury.

The telegraphic brotherhood recognizes the sisterhood.

Some of the strikers were circulating the following poetical effusion:

"We're bound to fight,
Our cause is right,
Monopoly is sore.
We've left our keys
To take our ease,
Let Jay Gould walk the floor."

One of the worst sold towns in the country, by the signal of the Telegraphers' Brotherhood, "General Grant dropped dead," was San Antonio, Texas. The operators were not in the secret, the news was given to the public, and the town went in mourning. The evening papers published eloquent obituaries, and the colored Republicans lifted up their voices and wept. The Denison *Herald-News* pays him the following tribute: "Grant has now passed from the stage of action here on earth, and while he was not idolized by the South he was by the North, and the impartial historian will record him a great man in many respects. He was not a brilliant man, but a man of no ordinary shrewdness, or little mental ability."—*Ex.*

NASHVILLE, TENN., July 14.—The Southern Time Telegraph Company was chartered here to-day. It is authorized to operate in Virginia and West Virginia, Tennessee, Georgia, North and South Carolina, Florida, Alabama, Mississippi, and Kentucky.

A friend and correspondent relates the following singular incident: "At the Locks, on the Savannah River, there is a telephone box kept by a lady. A few days ago the gong was sounded, and the lady, obeying its call, hastened to reply, and found coiled up nicely on the box a large live moccasin, over three feet long, with his neck nicely wrapped around the ear drum. Of course his snakeship was boss. Her son shot him."

Telegraphic.

AMSTERDAM, July 12th, 1883.

DEAR EDITOR,—I suppose your readers have heard of the International Exhibition at Amsterdam. The show is a good one and worthy of being seen. The city of Amsterdam is the metropolis of Holland; it has a population estimated between 350,000 and 380,000; the houses are built on piles, driven very deeply into the soil; the king's palace is supported by very nearly fifteen thousand of them. The city has the shape of a large fan, and contains some three hundred bridges.

The telegraph office is the sixth in importance of the capitals of Europe.

There are fifteen sub-offices, eleven of which are in direct communication with the central office. A total of two hundred and eighty-seven persons are employed in-doors and ninety-one carriers do the outside work. The instruments used are mostly constructed in France, by Digney, now the Société Générale des Telephones. There are thirty-eight Hughes, seventy-five Morse, and one Meyer (quadruplex) instruments.

The following figures will give an idea of the importance of the business transacted in 1882:

Telegrams received (sent).	602,000
" distributed....	644,090
" rec'd of transit.	1,275,666
Total.....	...2,521,956

Four sub-offices have Hughes' telegraph, the balance have only the Morse instruments.

The Commercial and Stock Exchange has a private office in direct connection with the exchanges of Paris, London, Brussels, Berlin, Frankfort-on-the-Main, and Rotterdam. The instruments are all of the Hughes pattern. The central office is lighted by Joblochkoff candles.

The Nederlandsche Bell Téléphoon Maatschappij has some nine hundred and fifty subscribers. The instrument used is the magneto-Blake-Bell. The lines are of 2 mm. steel galvanized wire, supported by elegant posts or by the house-tops. No return wire is used.

The Ader telephone used by the French is making its way in Holland; in a few years I shall not be surprised to see the Blake put aside, to be replaced by the Ader, as it is being done at present in Switzerland..

Europe has nothing to learn from America concerning telephones; it has even surpassed it in the opinion of many impartial minds. Mr. J. Berliner, of Hanover, has his instruments working telephonic concert-auditions in the Exhibition. Four rooms, connected separately by one steel-galvanized steel wire, with four distinct concert halls in the city, are provided each with fifty Berliner telephones connected, twenty-five in tension and two in quantity. The Berliner transmitters vary between eight and twelve in number in each concert hall. They are placed about ten feet above the orchestra and are worked by twenty large Calland cells and two large coils, the primary circuits of which are placed in tension and the secondary in quantity. The result obtained by this arrangement is principally a great economy in the cost of construction, which, I think, was the main object in view; the music is heard, however, quite well under the circumstances, but it does not give a just and true idea of the power of the telephone to the public in general. It cannot satisfy one who has heard the opera at the Paris Exhibition of 1881. I give great credit, nevertheless, to the promoters, who have been able to obtain the maximum of effects possible with a single wire.

I say nothing of the electric light, as I would have nothing very gracious to report on the subject. It goes out occasionally and remains so for a few nights—only!

There is nothing worth describing in the various electrical instruments exhibited by the manufacturers of the countries represented. The United States have not made an extraordinarily fine display. Sewing machines, safes, organs, pianos, an *English* bar, and the chromo of a large beer brewery, are the chief attractions in that section.

Yours, very respectfully,
GEORGE P. GRIGNARD.

Private Telegraph Wires.

SOME OF THE PECULIARITIES OF THEIR GROWTH AND USE—WHAT THEY COST, AND CUSTOMS IN REGARD TO THEM.

Telegraphing is done at wholesale as well as at retail. Individuals, firms and corporations who require large amounts of telegraphing manage to get it done either by private arrangements with the telegraph companies or by building their own lines. It is a very common thing for large corporations to build their own lines between their offices and their factories. They use their lines exclusively for their own business. But by far the greatest number of what are known as private wires are really owned by the telegraph companies, and are leased by special contract.

The longest private wire in use is from New York to Chicago. In the contracts are stringent provisions that the wire shall be used only for the private business of the contracting party, under penalty of terminating the contract. Certain periods of the day or night are fixed during which alone the wire may be used. Operators are furnished by the telegraph company.

The annual cost of leasing a private wire is from $20 to $40 a mile. The variation in price arises from the fact that in some cases the wires are quadruplexed, so that the same wire is used by different private persons, each sending messages at will, without the knowledge or interference of the other. The facilities of the large telegraph companies for keeping lines in good order have gradually concentrated the business in their hands, so that by far the largest mileage of private wires, so called, is in the hands of the Western Union Telegraph Company. The Baltimore and Ohio Railroad Company lease a number of private wires. In all cases the operators of the private lines leased from the companies are under the control of the latter, although paid by the lessees.

Most of the private lines, outside of the press lines, are hired by bankers and brokers, who require them only a few hours a day. At other hours the line becomes a public wire, or is leased to other private persons. Some of the large newspapers in the West have the use of private wires for a few hours at night, and thus avail themselves of the news of the great New York dailies the moment it is published.

It is impossible to give with accuracy the number of miles of private wires in use, but it is insignificant compared with the mileage of wires operated by companies. An official in the Western Union Company said: "There are only about 12,000 miles of really private wire in the United States. The Western Union Company operates 425,000 miles of wire, and other companies operate about 20,000. There are not over 600 miles of private wire in the Southern States."

There are three or four large establishments in New York where all the materials for putting up telegraph lines may be purchased, but the business of keeping a line in order requires so much experience that it naturally drifts into the hands of the telegraph companies, who, having the men and materials on hand, can always make repairs more easily and economically than private individuals. For this reason many private lines have been absorbed by the telegraph companies.

The Rapid Telegraph Company has more than fourteen thousand miles of completed wire, and it proposes to lease to the Western Union. Of course; the old story.

The Dallas *Herald* of the 17th instant says that Mr. D. M. Clower, superintendent of the Southwestern Telephone Company for North Texas, arrived home yesterday from a trip around his circuit. He will begin within the next few days to build a line from Gainesville to St. Joseph and Burlington or Spanish Fort, as it is more generally called, in Montague county, a distance of fifty-six miles. The citizens of those places have raised a bonus of $4,100 to secure the line, which will be extended to Bowie, ten miles further, which will make the line sixty-six miles in length. Poles are being distributed between this city and Sherman, which is sixty-four miles distant, for the erection of a line, and it will not be many days before the two places will have telephonic connection.

On one of the telegraphic systems in France a modification of the Blake transmitter has been introduced. It consists in replacing the microphonic system of Blake by a system composed simply of a ring of cork, behind which is placed a grill of five carbons, of which two are fixed and three movable. By this method very satisfactory results have been obtained, these micro-telephones having worked for nearly a year without requiring once to be touched. M. E. de la Bedoyère advocates the employment of the cork membrane, which gives much greater clearness to sounds and speech than the deal disc.

The British Insulite Company (limited), have introduced a useful form of battery. The cell is sealed, and can give off no fumes in a house where it may be employed. The outer vessel, which is rectangular, is made of insulite, a material impervious to liquid, and self-cementing. A partition of porous clay is cemented diagonally across the cell from corner to corner. In one corner is a zinc rod, and in the other is a carbon rod surrounded by pieces of carbon. A special solution is employed to excite the battery. The connections are made by binding screws on the lid, in which there is also a release valve, to provide for expansion of the air within. The cell, when sealed, can be inverted or put in any position without damage, and lasts two years without renewal of zinc.

New Telegraph Line.

OIL CITY, PA., July 24.—The Oil Exchange has appointed a committee of five to confer with the other oil exchanges on the subject of building a line of wires between the different exchanges. One man here will subscribe one-fourth of the necessary capital to build a line between Pittsburgh and Bradford.

A Telegraphic Blunder.

Telegraphic anecdotes being in order reminds us of a dispatch which some years ago a business man in this city sent to his correspondent in New York, requesting him to have a room reserved for him at the hotel, as he should come on that afternoon.

Arrived late at night he stood serenely behind the crowd at the old Astor House who were registering their names, even till the clerk began to turn applicants away for lack of room, assured that his dispatch in advance must have secured accommodation, but was surprised and indignant to find that no order for a room had been received, and was obliged to hunt up lodgings for the night elsewhere.

Early next morning, in response to the demand if his dispatch had been received, his correspondent replied in the affirmative, and said that a store-house had been hired for him in Beaver street as ordered.

"A store-house! I never ordered a store-house."

The dispatch was produced. It read: "Shall be on to-night; have room in a store-house secured at once."

Application at the telegraph office revealed the fact that the young woman who received the message as it came slowly from the wire supposed the operator had been abbreviating, and she therefore corrected (?) the spelling of the message, which originally read: "Have room in Astor House secured at once." The division of A-store and the addition of an e produced quite a different result than was desired.

Professor Alexander Graham Bell is preparing a catalogue of books and pamphlets on electrical matters, and has arranged over 40,000 titles already.

Scene in New street: First Lamb—"Helloa, Charles, are you in oil?" Second Lamb—"'In oil.' No! Do you take me for a demned sardine."

Correspondence.

Editor Electrical Review:

DEAR SIR: How can I get a good ground line in soil only 4 feet deep underneath which is solid limestone rock; also how can I obtain a light from the secondary current of an induction coil? Please answer through the columns of your paper, and oblige,

Respectfully yours,
CHAS. H. WRIGHT.

P. S.—I want ground for a ½-mile circuit.
C. H. W.

ANSWER:

There is no way of making a first-class ground in such soil as described, except to radiate a number of wires out underground in all directions from the main wire, fixing at the end of each radial wire a metal plate. Piling a lot of coke round each of the plates will help in improving the character of the ground wire.

There is no easy way to obtain light from the secondary current of an induction coil.

Incandescent electric lights have been, however, worked by including the filament in the secondary circuit of a coil, and passing a very strong current of electricity, constantly varied either in strength or direction through the primary coil. This has been done experimentally.

Editor Electrical Review:

DEAR SIR: Would you be so kind as to advise me on the following circumstances: I am making some delicate telephonic experiments, and I want some lampblack carbons as such used in Edison's carbon transmitter. Could you tell me where I could get or have some made outside of the telephone companies, which seem very restive to demands of every kind? You will oblige me, a subscriber,

July 23, 1883. S. L.

ANSWER:

The only way would be to apply either to Thomas A. Edison personally or to the American Bell Telephone Company. The exchanges have no authority to furnish such carbons.

Paragraphs About the Strike.

The operator's little game—"Key-no!"

They mean to strike when the wires are hot.

The operators will feel re-Morse, after a while.

Odd. The first order of battle among the operators is "Ground arms!"

"Never mind the wire—wherefore?" sing the operators.

Much eloquence among the op—orators.

The operators will now devote themselves to outside calls.

The operators think that "In Western Union there is weakness."

The operators must be peaceable. No assault on batteries.

The operators cannot be called wire-workers during their strike.

In reply to the demand for eight hours, Gen. Eckert stolidly answers, "Nein!"

The operators are in league with the conduit people. They are running the business into the ground.

The trouble with the operators will be a want of preparation. They will have nothing at their fingers' ends.

It is not Tilden who sends those cipher dispatches to the operators. The telegraphers do not sigh-for dispatches.

Edison says "electricity is a 10-acre lot with a high, close board fence around it." Ha, we had gathered the impression somehow that it was a kind of a Gould claim, merely staked off by a post and wire fence. Still, Edison may know a great deal more about that than we do; oh, a great deal—a very great deal. A great deal for Edison, that is, but not much in it for the rest of us.—*Burdett.*

Read Major LA RUE'S interesting Mexican letter, on tenth page.

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Storing Solar Energy.

Few subjects connected with physics are so little understood as the propagation of radiant heat. The recognized law that the temperature diminishes in the inverse ratio for the square of the distance from the radiating body has been found by that distinguished scientist, Captain Ericsson, to be true only of a sphere of perfectly uniform temperature at the surface when the distance is reckoned from the center of the sphere.

Sir Isaac Newton, referring to the intensity of the sun's radiant heat at different distances thus defines the law:

"The heat of the sun (at various distances) is as the density of its rays." He said further, that the densities of the diverging rays are reciprocally as the square of the distance from the center of the sun. This fact evidently has nothing to do with the main proposition, as it resulted simply from certain geometrical relations, viz.: that the areas of transverse sections of a cone are as the square of the distance from the apex.

Besides ascertaining the dynamic energy of solar radiation by measuring the units of heat developed in a given time under various conditions, Captain Ericsson, while working upon his solar engine, extended his labors to the determination of the true intensity of the sun's radient heat.

By a series of observations he was able to estimate the loss of intensity by the passage of the rays through the earth's atmosphere. By adding this to the ascertained intensity of the radiant heat on reaching the surface of the earth and before being affected by terrestrial radiation he determined the actual heat at the point where the rays entered the earth's atmosphere.

His attention was originally called to the important subject of actual intensity of solar radiation by reflecting on the limited amount of dynamic energy—by five units of heat per minute upon an area of 142 square inches exposed perpendicularly to the sun's rays while the thermometer indicated 150° above Fahrenheit's zero, or 610° above absolute zero.

Preliminary experiments carefully conducted disclosed the startling fact that the real intensity of solar radiation marks a point on the thermometric scale several hundred degrees below the freezing point of water.

Ericsson resorted to the expedient of concentrating the sun's rays by such a method that the degree of concentration could be accurately measured.

Investigation, conducted in conformity with this method of determining the true intensity of the radiant heat, proved the temperature to be nearly identical with that shown by the preliminary experiments.

Thus he established the extraordinary fact that the sun's rays, before gaining by terrestrial influences are so feeble that fluid mercury, contained in a shallow vessel from which the air is exhausted and covered with a thin lens of about 50" focus, and exposed to the full powers of a clear sun, will soon become solid, provided the vessel is prevented from receiving heat from surrounding substances.

It was while seeking a solution for the problem of the utilization of solar heat that these experiments were made, and it was in great measure due to these and kindred discoveries that he was enabled to perfect that admirable mechanism—the solar engine.

The narrow-minded will doubtless be inclined to sneer at something which cannot immediately be set to work coining money, but in the construction of this engine Ericsson has elucidated a principle, the practical application of which in the not distant future is likely to be of great advantage to the dwellers upon at least a part of the earth's surface.

The experience of the past shows that the exhaustion of the European coal fields must at some time cause great changes in favor of these countries which are in possession of continuous sun power.

Upper Egypt, for instance, will in the course of a few centuries derive signal advantage and attain a high political position on account of her perpetual sunshine and the consequent command of unlimited motive force.

The time will come when England must stop her mills for want of coal. Upper Egypt then, with her never-ceasing sun-power, will invite the European manufacturer to remove his machinery and erect his mills on the firm gounds along the sides of the alluvial plain of the Nile, where an amount of motive power may be obtained many times greater than that now employed in all the manufactories of Europe.

By means of the solar engine locomotives may be run across arid wastes where neither water nor fuel of any kind is to be had. Not that the solar engine can be elevated upon wheels, for the constantly changing angle the sun makes with the earth would prevent this, but locomotives may be fed from reservoirs of compressed air or electricity generated by stationary solar engines.

How it Used to Be and How it Is.

Away far back in the past when the successful feat of sending a message from one city to another and getting a reply thereto during the same day, was considered a most astonishing performance, the patrons of the telegraph at that time were not quite so exacting in their demands as they are at present.

The system was a new one then.

It was a great thing to be able to communicate at all.

And so looking at the new invention from this standpoint, many concessions were made and much consideration shown when the poor wires gave out, or other faults of construction or mechanism interrupted the regular flow of communication.

Even at this early day, however, it is recorded that, owing possibly to the fact of the transcriber of the tape having been overworked, or having forgotten his glasses (not those he might occasionally smile with) or for some other good and valid reason not specially mentioned, an error occurred in transmission which resulted in a loss of a certain amount to one of the patrons referred to.

Even then, as now, the aggrieved party thought his loss should be made good by the company, and he applied to them to the effect that they should respond accordingly. They did not take that view of the matter then, and they have never failed to act consistently on the point in question up to this very hour.

They are all of them entitled to commendation, at least for the unswerving fidelity with which the course thus early marked out has been followed.

Mr. F. O. C. Smith, at that time largely interested in the management of the affairs of the company called upon to settle, replied to the complainant in a very polite note, in which he soothingly and pathetically set forth the great advantages and benefits that the telegraph had conferred on business men, and that surely under such circumstances, where so much that was worthy of commendation and approval, was to be acknowledged, a little that was of the reverse character might be overlooked.

Perhaps it was; if not, at any rate it should have been, in consideration of the ingenuousness of the plea.

But is it right, after all, that a company should be called upon to make good losses caused by errors in transmission?

May be they should, and yet there are many things that might be said in their favor.

What seems a little strange is, that when correctness (absolute) is of great importance and the way to secure it is apparent, at a slight additional expense to be sure, the means thus provided are not made use of, and a matter of more than ordinary concern is undertaken and carried out in an ordinary way.

This point can be illustrated in numerous ways.

When anything that is highly prized, or of great value, is being transferred from place to place, the amount of care and watchfulness bestowed upon it is generally in proportion to its worth.

This rule or principle is so general in its application that those who fail to bring it into requisition, when the urgency of the case demands it, may be said to be guilty of contributory negligence in any loss that may accrue to them, for their failure to use the necessary and proper safeguards.

Another point that should not be overlooked, and which has a marked bearing on the question, is the wonderful smallness of the amount of tolls often paid, and the remarkable proportions to which the amount of damages reach.

Of course, as an offset to all this, proper and competent persons should be employed to do the work, which is not always the case.

Even admitting this, however, what business, it may be asked, is conducted in such a perfect way that where there are many in the service mistakes never occur?

It's always easy to find fault and destroy. The building up process is slower and requires something of an effort.

Recently the American District Telephone Company, which has heretofore operated the exchanges in the cities around the falls, was successful in effecting some important consolidations in telephone interests, which will assist, says the *Louisville Commercial*, the enterprise, in more fully supplying the wants of their subscribers. The consolidated company will erect lines connecting the important cities and towns of this and adjoining States. Communications can then be carried on in a much more satisfactory manner than has been possible in the past. The new organization has been completed, and will do business under the style of the Ohio Valley Telephone Company. The company has purchased the entire property and effects of the American District Telephone Company. New features will be introduced and improvements added until the line will offer every advantage. The Ohio Valley Company controls also several other adjacent interests, and before long the corporation expects to have a monopoly of the telephone business in this country. The capital stock of the new concern is $400,000. At a recent meeting of the stockholders the following officers were elected: President, J. B. Speed; Treasurer, Jas. Clark; Secretary, W. H. Mundy; General Manager, H. N. Gifford. It is said that the obstructions which have hitherto delayed the opening of the line to Cincinnati have been removed, and that the construction of the line will be commenced at an early date. The old company had made partial arrangements to extend a line via Bardstown and Springfield to Lebanon. This line is incorporated in the new deal, and will be erected at once. There is also a statement that lines will be built to connect with Nashville and Indianapolis. It is probable that the corporation will extend their way down the Ohio on the south side as far as Owensboro, making intermediate connections.

The New Albany correspondent gives the following in the *Louisville Commercial:*

Hello, Miss Exchange! Buz-z-z-z—Hello! Will there be any strike among the telegraph operators here? No; none of the telegraphers belong to the brotherhood. Will there be any strike among the telephone operators here? Big laugh, followed by, I guess not. Why? Because it would do us no good; we might get discharged. Do you think the box owners would howl if "you all" were to strike? The howling then would be no greater than now. How so? Because everybody wants to use the lines at the same time. Then, you think there will be no interruption of telephone business between this city and Corydon? Not to speak of, unless the drug man down there who officiates as operator had a large influx of customers for quinine and chill cure from the citizens of the town and county. By-bye! Ting, ting.

An Eventful Life Ended.

William T. Carlton, of Brockton, whose connection with electrical and scientific matters abroad has made him widely known in Great Britain and other countries of the Old World, died at his residence at Salisbury Square, Brockton, Mass., last Saturday evening. The accompanying story of his life, gathered at various times during his residence in Brockton, is not in all respects corroborated by documentary evidence, but is believed to be truthful and accurate:

Mr. Carlton was born in Buckinghamshire, England, in January, 1838, and received an excellent education at institutions in that vicinity. He early evinced a decided taste for the study of electrical phenomena, especially the chemistry of electricity, and was so enthusiastic in his researches in this direction that when but twenty years old he was admitted to one of the famous Wheatstone offices in the early days of the cable system. While there he became thoroughly posted on electrical matters, and was connected with important lines of telegraph in England, Gibraltar and the Isle of Malta. He afterwards completed a course at the College of Engineers, and was finally brought to the notice of the British officials, and received, in 1866, the important appointment of Master of Construction of a section of upward of 1,000 miles of the Euphrates telegraph line. The fact that this line is now known as one of the most thoroughly constructed and equipped in the Old World attests the faithfulness with which the work was done. As he started upon this important mission in August, 1866, leaving a bride of two months, Mr. Carlton was a splendid specimen of physical manhood, but on his return seven years after he was a physical wreck. During this period the terrible famine of 1870 caused suffering which could be only partially relieved by the aid which he was enabled to dispense at his station in Teheran. Here Stanley, of the New York *Herald*, afterward the great African explorer, was for some time entertained. Mr. Carlton acquired, by association with the highest society in the cities where he at times made his headquarters, an exhaustive knowledge of the Persian language and literture. Partially regaining his health he engaged in mercantile pursuits, but meeting with pecuniary reverses, his electrical knowledge and experience secured him a position as Assistant Superintendent of the Bell Telephone Exchange in London. The consolidation with the Edison interests scattered the Bell officers, and Mr. Carlton was employed in the testing of ocean cables, in the great factory of Siemens Brothers, until the confinement proved too exhausting, and he left his native land and went to Halifax, N. S., to complete a telegraph line there in process of construction. After remaining in the Provinces for some time he came to New England, and after a period of employment by the Telephone Dispatch Company, of Boston, was attracted to that city by an offer of a position in the Brockton Telephone Exchange.

American Electric and Illuminating Company.

The business of this company is rapidly extending, and several combinations are now being formed with the object in view for the introduction of this system, which, when accomplished, will practically give this company the control of the arc-lighting business not only in New England but also in New York State. The company have already absorbed the business of the N. E. Weston Electric Light Company in Lowell, and, what is of great significance, Messrs. Ingham and Downs, of the Lowell Syndicate and Bell Telephone Company have recently joined the ranks of the American Company, bringing with them strong financial support. The officers of one of the strongest national banks in New England outside of Boston, have just closed a contract for the purchase from the American Company of an entire lighting station, and the company are negotiating for the sale of three more lighting plants, now in process of construction, to well-known banking houses.

The success of this company has always been predicted by those posted and by the ELECTRICAL REVIEW, but to the public generally facts speak louder than predictions. Now the directors of the American Company meet next week for the purpose of declaring an extra 2 per cent. semi-annual dividend on both the preferred and common stock of the company, which, in addition to the regular 4 per cent. semi-annual dividend on the preferred stock—which is payable on the 1st of March and September yearly—makes the preferred a 12 per cent. stock and the common a 4 per cent. one.

In this connection we would state, as a matter of interest and value, that Professor Thomson has perfected his half and quarter light arc lamp, which will more than double the present commercial value of the Thomson-Houston system.

The Southwestern District of the Erie Telephone and Telegraph Company bought at auction recently the following section of the United States military telegraph lines: From San Antonio to Eagle Pass, 167 miles; Coleman to Henrietta, 178 miles; Concho to Stockton, 158 miles; the line from San Antonio to Concho, 222 miles, was bought by the Telephone and Telegraph Company. These lines will be immediately placed in working condition, and within ten days will be in operation between the points named and working in connection with the Western Union telegraph lines. The Erie Company has 260 miles of territorial line in the district in actual operation, 709 miles under contract and in course of construction, besides the 520 miles bought of the Government to-day. The company has twenty-one exchanges in operation, and exchanges at El Paso, Brownsville, Laredo, Corpus Christi, McKinney, Longview, Waxahachie, Terrell, Benton, and Tyler in course of construction.

The Wilmington *Star* says: "We understand that the Telephone Company has purchased the Masonboro line connecting with this city, and will run branch telephone lines to Greenville and Wrightsville Sounds, where stations will be located. This will be a source of great convenience to those residing at or visiting our summer resorts.

How the Telegraphic Strike Interfered With Love's Young Dream.

"Adelbert!"

The moon came softly through the trees, and the gentle breeze that touched her fair young face wafted thither the sweet odor of the fragrant clover and of the still more fragrant sty. As she put her arms around his neck—those arms that had never known what work was, except on that eventful day when the cook eloped with the hired man—there came into her eyes a tender, loving look that told all too plainly how dearly Cleopatra Wood loved him. As she spoke the name with which this paragraph begins and gazed into his eyes with a tender, yearning, lend-me-a quarter-till-next-week look, there was something that told of an empty somewhat somewhere. The name she had spoken was more to her than the last cigar to an old smoker, and when she uttered it and received no response, her heart was wrenched with its terrible agony.

"Will you not?" she cries, in low, agonizing tones.

"Alas!" said Adelbert Jones, trying to tear himself away from so terrible a scene, "I cannot"; and releasing her tender hold upon him, he sank upon the ground with a dull thud.

"Can you not send me one short message?" she cries.

"Great heavens! do not drive me to suicide," he answers. "Must I tell you? The telegraphers are all on a strike, and I cannot, cannot do it."

"And will the strike never end?" she pleads.

"Not till Jay Gould joins the Salvation Army," he mutters between his clenched teeth, and with a groan he leaps into the darkness and disappears. —*Ex.*

Electrical Notes.

The Western Union Telegraph Company took down their sign, "Messages Received Subject to Delay," on Saturday last.

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To those who, like myself, believe that electricity, as an illuminant, will ultimately supersede gas, the present outlook is very encouraging.

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No doubt most of the men who have been practically interested in working out the various electric-light problems would answer to this, that the advantages of electricity over gas have always been apparent; the only trouble being to induce the public to put up the necessary capital.

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It is because capital is now forthcoming and the public educated up to using the light, that I started off by saying the present outlook was encouraging.

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To what shall we ascribe the reason for this sudden awakening of public interest and confidence in the efficiency of electricity as an illuminant?

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Were I so bold as to hazard an opinion upon so important a question; so bold as to set my humble opinion against that of the learned gentlemen who believe themselves the only constituted authority upon such matters, I should say that the reason is that electricians are talking less and doing more than has been their wont.

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If I am wrong, I hope some one will correct me.

***

Having been on the ground when the first improvements were made in the dynamo and written the first description of the mechanism of the incandescent lamp now in use; a description given me by the man who made it, and having watched the subsequent career—if I may use such a term—of the lamp, it will, perhaps, not be considered as presumption on my part to claim a slight knowledge of how the electric lighting campaign has been conducted.

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For several years, indeed up to a quite recent date, some of the leading electricians contented themselves with declarations of what they were going to do.

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Then they seemed, so far as the public was concerned, to retire into private life for a while, and upon again emerging promise even greater things.

***

As everybody knows that reads the papers, the public after a while became somewhat tired of hearing of the great benefits it was to receive by reason of the introduction of electricity as an illuminant.

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Consumers of gas had been abused, bullied would perhaps better express the treatment they had received from the gas people, and so, of course, they could not be expected to waste upon them any ardor of affection and they liked their illuminating fluid even less.

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But they required a light for their dwellings, and as the promises of the electricians were not immediately fulfilled – for the public cannot be expected to reason—they lost confidence in electrical lighting and continued to use gas.

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But now, as said before, the electricians, having at last devoted themselves to practical development of electric lighting, the public has regained confidence, and before long will discover that, though the promises held out by electricians some years since were somewhat premature, they were based upon a foundation of truth.

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There are those reliable men, too, who insist that incandescent lighting, when the electricity is generated by steam in large quantities, is more economical than coal gas, and again that a greater intensity of light may be had by electric lamps fed from a dynamo worked by a gas engine, than could be had if the gas used as fuel was burned directly as an illuminant.

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Of the latter I think there can be little doubt, since there is abundant evidence to maintain the assertion; but as to the latter, I am by no means certain, its truth or falsity depending upon the distance of the installation from the coal mines.

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But the discoveries of M. Deprez in the transmission of electrical power to a distance will, there is reason to believe, settle this question by doing away with the need of fuel altogether in the generation of frictional electricity.

***

Then the gas people, let them save what they may in the cost of their fluid through the sale of residuents, they cannot get their gas for nothing, while this is precisely what the electric light people will be able to do with the electric current.

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In England, however, it is openly claimed that incandescent lighting is cheaper than gas, even when the generators are worked by the intervention of steam.

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Against the argument that may here be interposed that coal is cheaper in England than here, it may be said that this is to a certain extent equalized by the fact that gas is furnished to consumers at a cost much less than that which obtains here.

***

It is, of course, unfair to electric lighting to compare the cost per sixteen candle-power lamp installation, of small magnitude, with the cost per gas jet in a large installation, just as absurd as, should it be required to ascertain the price of flour in a certain city, a few pounds were purchased at a retailer's instead of a hundred barrels in the open market.

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Yet, even under such an unfair comparison, the incandescent light has made a fine showing in point of expense.

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Some time since the South Wales Steel, Iron, and Tin-plate Works, at Llanelly, were lighted with incandescent lamps, one hundred in number.

***

Some months later the gas people, with that spirit of fair play and decency which for so long has characterized their dealings, spread a report by means of their organs that the attempt to light these works by incandescent lights had proved a lamentable failure; that the light was unreliable, and the cost of installation, when compared with gas, excessive.

***

This story, which was made out of the whole cloth by the gas people, so incensed the proprietors of the works, Messrs. Morewood & Co., that they published a denial of the story, and gave an account of their experience with incandescent lighting, which showed the facts were just the contrary as stated by the gas people.

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These critical gentlemen were, to use a slang phrase, in the right church but the wrong pew.

***

Messrs. Morewood & Co. started an installation of fifty lamps, November 1st, 1882, and after a month's trial were so well pleased with the light, both as to cost and quality as compared to gas, that they ordered a second dynamo, machine, cables, &c., which resulted in a total of one hundred lights.

***

Up to the present time they have been working regularly every night, except, of course, Saturday and Sunday nights.

Assorting rooms, tin houses, annealing and pickling rooms, cold-roll room, and several mills are lighted by the incandescent lamps; and the only trouble that has been experienced has been in the tin houses, where the dust from the bran and the smoke from the grease-pots collected upon the lamps, requiring them to be dusted every evening.

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Messrs. Morewood & Co. say that as to the comparative cost of the incandescent light and gas, there can be no question that for an equal candle-power the electric light is the cheaper, with gas at ninety cents the thousand cubic feet, and that even when making their own gas, as they do, there is considerable doubt, they say, whether or not the electric light is not the more economical of the two; in addition to which they have what in their opinion is a superior quality of light.

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A six months' experience is too short, of course, to enable Messrs. Morewood & Co. to give an estimate of the cost of electric lighting, as some parts of the machines only require renewing once in every two or three years.

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As yet, the cost of renewals has been little or nothing, except in lamps.

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They estimate, however, over a series of years this item of expense will not exceed three hundred dollars per year for one hundred lights, exclusive of lamps, and this is confirmed by the reports of others, who say that ten per cent. upon the cost of the plant will quite cover repairs, and three hundred dollars is a great deal in excess of ten per cent. upon the cost of the plant established by Messrs. Morewood & Co. Taking this sum as the expenditure on repairs, the cost of the electric light they say will be as follows, in cases similar to their own, where there is spare steam at night:

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Wages, $310; lamps, $450; repairs, $300; oil and stores, $65. Total, $1,125. Deduct from this work done by engineer, $210. This leaves a balance of $915.

***

This cost is for one hundred lamps of seventeen-candle power for a year, using them on an average five nights a week for fourteen hours in the winter six months, and nine hours in the summer six months.

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This gives a total of 2,990 hours, during all of which they have had 1,700-candle power of light for the sum of $915.

***

"What," they ask, "would an equal light cost in gas at 3s. 9d. for one thousand cubic feet?"

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"We cannot calculate on burning less than one cubic foot of gas per hour for every three-candles' power; so, to get 1,700-candle power for 2,990 hours, we should burn 1,694,300 cubic feet of gas, costing £317 14s. 7d., against £183 13s. 4d. for the same light if supplied by the incandescence system electric system."

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"If we had to raise steam to generate the electricity, we should have extra expenses in coal and labor as follows":

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"Every ten lamps require one-horse power, so we should want ten-horse power for our one hundred lamps, which, with a fairly good boiler and engine, would consume thirty pounds of coal per hour, or forty tons per year, which, at five shillings a ton, equals £10."

***

"In addition to this, we cannot expect the engineer to do any turning, as he has to fire the boiler, and there are other small expenses to be met, bringing the extra cost through having to raise steam to £56 6s. 8d., giving a total for one hundred lamps of £240 per annum, against £317 14s. 7d. for gas."

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If the reports which have recently come from England may be relied upon, the power-meter which Mr. C. W. Siemens has devised, besides being ingenious, is very efficient as well.

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A thick and thin coil is attached to this power-meter.

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Messrs. Ayrton & Perry have constructed a very simple erg-meter, which consists of an ordinary eight-day clock from which the pendulum bob has been removed. A coil of coated wire being substituted for this is hung in the middle of a larger coil, which acts as a magnet.

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When a current is passed through the coil-pendulum, its beats, which may easily be timed by a watch, are reduced; whereas, when the current is reversed, the beats are more rapid, the clock losing or gaining according to the direction of the current, and the loss or gain is found to be proportional to the power.

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The half-horse power Sellon-Volckmar-Faure cell is equivalent to twenty amperes, two volts in nine hours, and the horse-power cell is just double that power, and is equal to the raising of nearly two million foot-pounds.

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Though, perhaps, a single cell may not yield so much work as this represents, yet good authorities say they have found that, if a larger number are used in combination, they will perform the work required.

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The number of uses to which the secondary battery may be put is, indeed, remarkable.

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As stores from which to feed lamps used in the various descriptions of conveyance, they have already proved most useful.

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Small vessels, like the steam launch, cabs and tricycles may carry with them, nicely packed under their seats, small secondary batteries, but of sufficient power to take them upon short journeys.

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By means of these batteries, a higher power than an engine will give may be had.

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Those who have seen lights furnished from a secondary battery have been surprised at their steadiness, when compared with those where electricity is generated through the intervention of a steam engine.

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When it is used for electric installations, the reservoir, so to speak, will be located centrally, but there are, it is said, many advantages in having individual boxes in each dwelling.

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The central supply of electromotive force will, of course, be available equally for incandescent, arc and other forms of lamp.

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There are certainly many advantages to be had by using secondary batteries instead of dynamos worked by engines.

***

In the first instance, if all the lights but one are turned out, there will be no perceptible increase or decrease of the intensity of that remaining; whilst, in the latter case, should the dynamos be kept running with but one light, the latter would very probably burst from excessive current when the switching out of circuit took place.

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The electrical resistance of these cells internally is very low; that is to say, it is said to be as small as .0016 of an ohm, rising to .002 of an ohm when nearly exhausted.

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When a gas engine is employed, it is not necessary as with a steam-engine to keep it continuously at work, and with such a motor the secondary battery might be used as a regulator rather than as a store.

Mexican Tramps.

Leaving Mexico at 6 A. M. via Mexican-Vera Cruz Railroad, arrived at Apizaco at 10:30, where I changed cars for Puebla, arriving there at 12:30 P. M. A good breakfast and to business, which was duly dispatched. Having arranged to take an early start next morning for the Atoyac de Pacific, the afternoon was devoted to sight-seeing in the beautiful City of Puebla, one of the cleanest, brightest, most attractive cities, if not *the* finest in Mexico.

The first visit was to the grand Cathedral, the finest in the whole Republic. An imposing stone building of huge dimensions, with a well-proportioned tower in which bells of enormous size are hanging, plainly visible from the highway. Entering, we find services just opened and take a front seat. The music is furnished by an orchestra of perhaps 30 members performing on string and wind instruments of all kinds, besides two elegant reed organs, the largest of which is 50 to 60 feet high. Together with the choir, the music was superb, probably equal to any in the United States, for Mexicans are masters of music and painting.

The walls and floors are the beautiful marble for which Puebla is celebrated, and the altars are of gold and silver—massive and genuine. The paintings with which the many small rooms opening into the Cathedral proper are decorated, are rare and perfect works, chiefly representing our Saviour performing some of his good deeds on earth.

Without being irreverent, I will simply repeat what has been told to me, that at Guadalupe, in a church, Christ is presented in life-size, head adorned with a stylish "plug" hat. I have not seen it, but do not doubt the statement, and shall visit the place soon to prove it.

Our guide informed us that no cost had been recorded, but that it is estimated that the Cathedral cost $60,000,000 up to the present date, and they are still working at it—outside and in. Viewing it from the main entrance one would almost believe any figure mentioned, for the sight is certainly unequaled as regards elegance and lavishness.

During the last revolution a lamp of solid gold, large enough to hold three men, was taken from its hangings over the center altar. Remember I am repeating what was given me as facts, but will not be held for their correctness, yet while facing the many remaining images of gold and silver one would scarcely discredit anything.

Leaving the Cathedral to the worshipers, kneeling here and there all over the room, performing their devotions in silence by many motions of the hands over face and breast, we wandered through the Zocola, where a brass band was producing very creditable music. Thence to the Military Hospital and San Francisco Park, where another band was delighting a motley crowd. Puebla has a population of 80,000, not counting bands.

Supper followed, then adjourned to the central office of the Puebla Telephone Company to do some writing. This office deserves special mention for its completeness of arrangement and beautiful design, showing the efficiency of its general manager, W. E. Huntington, who has established a model company in every respect.

Now to Hotel Diligencias, where a comfortable room was secured for the night.

Called at 6 A. M., and at 7 o'clock we, Srs. Tamariz and Labato and self, were rushed out of the city in a stage, bound for the Atoyac River, to examine the improvements being made in the shape of a canal to carry 66 per cent. of the water through the mountains to Alixco Valley for manufacturing and irrigation purposes. The enterprise is gigantic and will be the source of a large revenue to the owners of the water.

The Presa (dam) already elected, is a magnificent piece of engineering, the labor of Mnsr. Leon Cassan, the eminent architect, whose name is a guarantee of the ablest work known to mechanical skill.

Five kilometers further on we were met by Mons. Cassan, who escorted us through a tunnel in course of construction through a mountain, and then invited us to a splendid dinner, which was duly punished. At this point we must take horses, as the trail over the range would not permit any easier mode of travel.

Sr. Tamariz decided to return to Puebla, so we bade him godspeed and started on our journey to the famous Atlixco Valley. The trip over the mountains was enjoyed and safely made without incident. On entering the valley we were fairly enchanted. A second edition of the Garden of Eden. Corn, wheat, sugar cane, cotton, coffee, oranges, bananas, peaches, apricots, apples, pears and all the varieties of native fruits and flowers grow spontaneously. The air was laden with sweetest perfumes. Everything in abundance, excepting water, and now that is being provided for. A ride of 1½ hours brought us to the town of Atlixco, population 12,000, *and bands*, which were playing, it being a feast day, called Saint Peter.

Applying at Hotel Morelos, we were accommodated with comfortable quarters and good food. 'Twas now 3:30 P. M., and after lunching, washed down with St. Louis Anheuser, found in the lockers, we took a tour of inspection through the city. The houses are badly cracked, evidences of shocks received from old Popocatepetl, which looms up a short distance to the west, snow covered and an inveterate smoker.

We stepped into a private garden where I plucked a small twig from an orange tree on which there hung six oranges. Of course they were not watermelons, yet I would not have been surprised if they had been, for I think it possible to raise anything and in any style in the delightful climate at this place. Coffee hung in bunches all over the bushes.

Being booked for an early start next morning, we retired early, hoping that Popocatepetl would not give us a shaking up during the night, it being one year ago the 19th of this month since she was on a tear.

Coffee at 5 o'clock, and away we gallop over a mountain range, bound for San Augustine, which we reached at 7 o'clock, having had one hour in a heavy rain storm, yet our rubber coats kept us dry enough.

We now abandoned the horses and took street cars for Puebla, 38 kilometers, which we made in 3 hours, including three long stops—pretty good time for street cars. I venture to say that this is the fastest street-car line in the world. Imagine the hitching of 4 or 6 wild mules to a light car and spinning down the mountains as fast as the critters could run, impelled by whip, yells of driver and car on their very heels. Oh, the pace was terrific.

We passed Cholula, where stands the historic mountain church, of Cortez fame, where 3,000 persons were put to death for conspiracy. The church was erected away back in the 16th century, destroyed by revolutionists, and rebuilt in 1867.

The return trip safely landed us in Puebla, where our horses soon after arrived, having come over the trail in charge of an Indian.

I induced Mons. Cassan to accompany me to Mexico, where we landed at 8 P. M., after a delightful ride over as good a road-bed as you will find anywhere.

Twenty miles out from Mexico the electric light tower is plainly visible, looking like the evening star. It is a source of much wonderment on the part of "los Indios."

Parties wishing to do Popocatepetl can make the best arrangements by taking the route from Puebla, which I have described as the Lightning Mule Line, to Atlixco, where horses and guides can be secured. To do the volcano properly will require four days. The ascent is made in from six to eight hours, as the conditions warrant, while the descent is accomplished in seven to ten *minutes*, as it is made on a board, sled fashion, sliding down the mountain at a go-as-you-can't-help-yourself gait. The snow is about waist deep on the top of the peak, at the present writing, and is about the same the year round. The only risk to run is that it might be Popo's off day, in which case your friends would not be at any expense for a funeral; yet the

advantage of being right *at the sulphur works* is a consolation.

From the summit, the City of Mexico—about 65 miles distant—looks like a toy block city. Some photographs taken on the spot can now be had of Messrs. Gove & North, Mexico, who made the trip with their instruments, and made some good views.

The Fourth of July will be duly celebrated by us Americans, picnicing *en masse*, and making ourselves believe we are at home. At this writing, the programme has not been definitely settled, but it is understood that Judge Morgan, United States Minister, will make the eagle-screaming address.

Mr L. E. Allen, Director General of the Mexican Pacific Telephone Company, is in the city negotiating the purchase of additional valuable territory now owned by the Mexican Company. The latter is now in a flourishing condition under the efficient and popular management of Judge Wiley.

Mr. W. E. Huntington, who brought the Puebla Telephone Company to the front, has accepted the position of General Manager of the Central Telephone Company, with headquarters at Leon, reporting July 1. He is ably assisted by Mr. Commercial Jones, Assistant Manager, with headquarters at San Luis Potosi.

The new and elegant offices of the Mexican Telephone Company, this city, have been opened, and the increased business in new subscribers speaks well for the change. The position of auditor, recently vacated by the return of Mr. S. T. Wyatt to New York on account of ill-health, has been filled by Mr. Maurice L. Guiraud, well and favorably known in Paris, New Orleans and Mexico, formerly cashier Mexican Central Railroad at Tampico.

Mr. Jose L. Rowe is the popular cashier, with Srs. Dominguez, Sardineta and España as assistant in collections. Mnsr. F. E. La Croix has charge of the supply department at Tacuba.

Mr. M. S. Gardner, Superintendent of Construction, seconded by S. R. Wallace and J. Enright, Foreman, Marquet, Watts and Brown, inspectors and general utility men; Wandell, Perrin and Wynne, linemen, besides a force of natives under the charge of Antolino Pontigo.

At Guadalajara business is being pushed with satisfactory results under the able management of Mr. D. J. Hobart.

Our rainy season is fully inaugurated. It is not an uncommon sight to see a peon carrying a lady across the street for politeness and a real (12½c.)

GEO. W. LA RUE.

In speaking of the Louisville Exposition a local paper says: There is a vast deal of work to be done before the exposition is completed. The management has no time to play.

It is a mistake to represent that the exhibits are arriving in vast bulks and being placed in the building A few pieces of machinery is all that can be seen.

The Department of Exhibits are overwhelmed with work. It seems almost impossible to avoid complication in this department, and the managers are being put to a great deal of unnecessary labor. It seems to be the chief aim of the exhibitors to rush in all their applications by the same mail. In this way matters become confused. The small amount of space yet to be apportioned increases the confusion. It is to be hoped that the business in this department will be facilitated by proper means, and that the unnecessary crowding of the exhibitors will cease.

A Drawbaugh Telephone Company.

The certificate of incorporation of the Drawbaugh Telephone and Telegraph Company was filed in the County Clerk's office Saturday. The corporators are William Enos Walkley, Albert Palmer Fisher, Charles Duryea Beach and Herbert Valentine. The capital stock of the company is $15,000,000, divided into 300,000 shares of $50 each.

Manufacturing News.

Trenton, Tenn., is building a cotton-seed oil mill.

A pig iron furnace is to be started at Alpine, Ala.

The Phœnix Iron Works, Winona, Minn., are adding a number of improvements to their shop. They are building a new machine shop 30x100 feet, two stories high, of brick, and are changing and enlarging some of their old buildings.

The June Manufacturing Company of Chicago have opened their new shops for making machine screws and machinery. The building is brick, 54x100 feet, four stories and basement. A 55-horse power engine furnishes the power.

The Diebold Safe and Lock Company, of Canton, O., have under contemplation the erection of a large building, 100x250 feet in size, and for this purpose purchased over two acres of land in the rear of their present shops, from C. Aultman & Co.

The Executive Committee of the National Exhibition to be held in Turin from April to October, 1884, has decided to set apart a section for an International Exhibition of Electricity, in which home and foreign exhibitors may alike compete for prizes. Applications must be made previous to August 31.

A Vienna paper says the electric light has been introduced in the wards and operating room of the general infirmary in that city. There is a portable as well as a fixed lamp in each ward. The accumulator system obviates the necessity of the dynamo working at night, but it states that it is too expensive for general adoption.

A reeler of silk in New Orleans, who has hitherto employed some nineteen hands, proposes to go into the manufacture of silk fabrics, and to organize a joint stock company for that purpose. He has already reeled 1,500 pounds of silk, and has an importation of cocoons on the way from France of 1,200 pounds.

The Youngstown Car Manufacturing Company was organized on the 23d ult., with a capital of $100,000. L. E. Cochrane is president, B. F. Boyd, secretary and treasurer, and Andrew Miliken, general manager. The new concern takes charge of the business of the Youngstown Car Works, which has been doing a successful business for three years.

The Clifton Iron Company has completed a narrow-gauge railroad from the Alabama furnace to their ore banks nine miles distant, and the town of Clifton has sprung up like magic at the mines. Development and progress is Alabama's watchword. The Alabama furnace is immediately on the Selma, Rome & Dalton division of the East Tennessee, Virginia & Dalton Railroad.

The Wachusett Electric Light Company of Fitchburg, Mass., has made considerable progress since completing their plant, and are, notwithstanding the long days when lighting is at its minimum, closing up contracts for nearly their whole capacity—85 lights The stock of this local company, the par value of which is $10 per share, has advanced within a few days to $15. The company has discontinued the issue of stock.

Mr. Sanger has received a reply to his inquiry as to what points the proposed telephone line to Dallas would be connected with. They are as follows: Lancaster, Red Oak, Waxahachie, Italy, Milford, Ennis, Denton, Sherman, and Fort Worth. To-morrow he will make the rounds and ascertain if the guarantee of business to the amount of $100 gross per month can be made. There is little doubt that the project will be successful.—*Galveston (Texas) Daily News*, July 21.

On the night of July 12 the new department of the Indiana University was discovered to be on fire. The laboratory was soon in flames, and shortly afterward the library and museum The latter contained the famous Owen collection and Dr. Jordan's collection of fishes. The library had 15,000 volumes in it. The new building was entirely destroyed. The fire was caused by lightning striking a telephone wire.

The Westinghouse Machine Company, Pittsburgh, say in the Chicago *Journal of Commerce:*

"We are now confining ourselves exclusively to the manufacture of the Westinghouse engine, employing about one hundred and seventy-five men. Business was never so good; our month's trade shows a material increase over the month preceding, and we are now shipping over two engines per day of average size. We have this season commenced the construction of automatic engines, and have now in hand orders for a number averaging from 100 to 200 horse-power. We have recently opened a branch office in Chicago, and also in Dallas, Texas, with very satisfactory results.

Yours, very truly,
THE WESTINGHOUSE MACHINE CO.

A new engine which is used to some extent for electric light purposes in the West, is the Reynolds-Corliss. It is manufactured by Messrs. Edward P. Allis & Co., of the Reliance Works, Milwaukee, Wis., who have recently received an order from the Nashville Mill Company for a 14x36" engine complete with boiler, heater, pumps, &c. This company have also the following orders upon their books: from the Haxtun Steam Heating Company of Kawanne, Ill, a 22x48; the Plano (Ill.) Manufacturing Company, a 26x48; the Texarkana (Ark) Oil and Manufacturing Company, a 18x42 and a 32x48 for the George P. Plant Milling Company of St. Louis; one 12x36 for the Milwaukee Industrial Exposition to furnish power for electric light plants; the George T. Smith Middlings Purifier Company, of Jackson, Mich., a 12x30, and the La Crosse (Wis.) Brush Electric Light and Power Company, a 14x36. These orders with that of the Louisville Exposition Company, who will have one of these engines to furnish power for the exposition, makes an array of fine formation to the buyer at once practical and conclusive.

How Big is the Barb Wire?

An interested correspondent writes to a Western contemporary as follows:

CEDAR RAPIDS, IOWA, June 30, 1883.
Editor Chicago Journal of Commerce:

Please inform me how large this barb wire fence is. Respectfully,
GUSTAVE BRŒCKSMIDT.

The size of it for the year 1882 was a production of 160,000,000 lbs., upon which the makers paid to the holders of certain patents a royalty of ⅜ cents a pound, making the size of it about $1,200,000. As the legal contest has compelled Washburn & Moen to reduce the royalty to ⅜ of a cent per pound, the size of it for the next year in a production of 200,000,000 lbs. will be $750,000. This is pretty large size barb wire.

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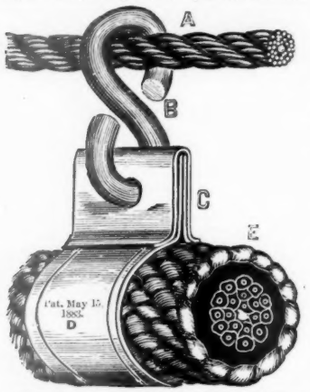

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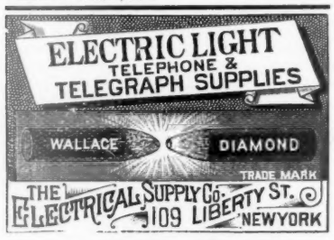

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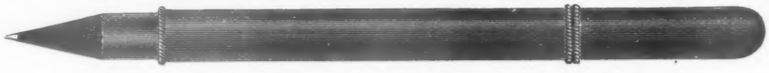

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The Commission of the International Electric Exhibition at Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August,** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors. The Regulations and the blanks necessary for Applications are to be had at the **Austrian-Hungarian Consuls.** The objects to be exposed will comprise all Machinery, Apparatuses and Implements connected with Electrotechnic It will certainly afford a good opportunity to inventors to show their latest improvements. This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well-remembered Universal Exhibition of 1873. Exhibitors are requested to procure the necessary papers at once.

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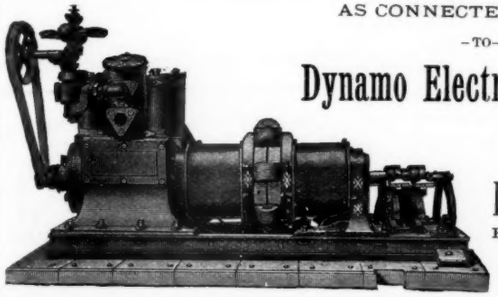

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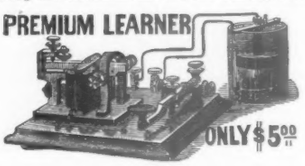

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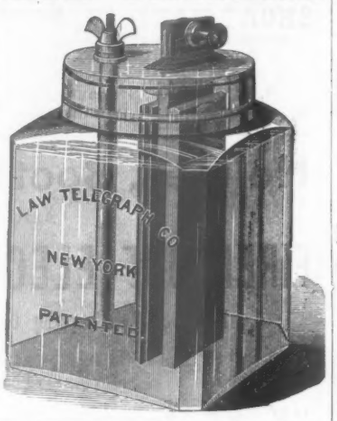

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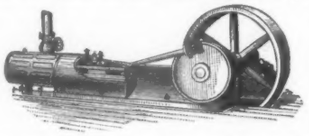

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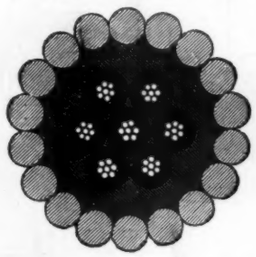

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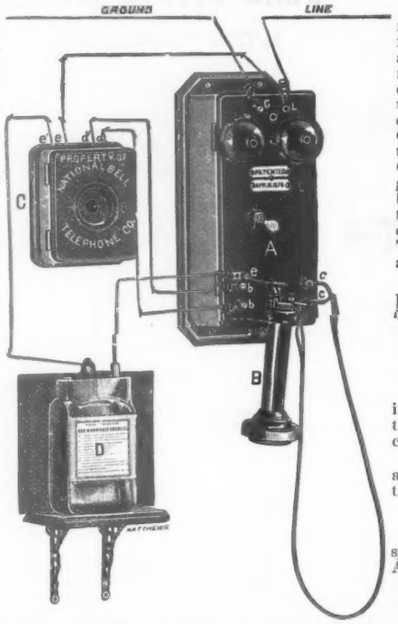

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